Exhibit 2

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF NEW YORK

IN RE:

INTEREST RATE SWAPS ANTITRUST LITIGATION

16-MD-2704 (JPO)
17-MC-2704 (JPO)

This Document Relates to the Class Action.

EXPERT REPLY REPORT OF PETER C. REISS

November 27, 2019

SUBJECT TO PROTECTIVE ORDER – PRIVILEGED AND HIGHLY CONFIDENTIAL

Table of Contents

I. Overview and Summary of Opinions

1. Professors Duffie and Grinblatt submitted initial expert reports dated February 20, 2019 ("Initial Reports") analyzing whether alleged collusion by Dealer Defendants to prevent the emergence of anonymous all-to-all (AA2A) trading platforms for interest rate swap products caused all or nearly all buy-side customers to suffer economic injury.[1] Professor Grinblatt also proposed a methodology for assessing damages. I submitted a report on June 18, 2019 ("Reiss Initial Report), and subsequently Professors Duffie and Grinblatt submitted lengthy rebuttal reports on October 1, 2019 ("Duffie Rebuttal Report" and "Grinblatt Rebuttal Report").

- My prior opinions have not changed after reviewing and evaluating the Rebuttal Reports. I also have formed new opinions that are summarized as follows: Plaintiffs' experts attempt to isolate their theory of common impact from the measurement of damages. They are not separable. If, as Professor Grinblatt claims, his damage model is sound, and that model finds certain transactions and customers were not harmed, this is evidence that should be considered in determining whether those trades and customers were impacted by the alleged conspiracy.
- Plaintiffs' experts use theoretical arguments to assert common impact. These theoretical arguments alone do not support the conclusion that all or nearly all class members were harmed. The academic literature is ambiguous about the effects of introducing AA2A trading on spreads.
- Plaintiffs' experts, Professor Grinblatt in particular, continue to deny evidence in the data, testimony and depositions produced in this matter that customers paid widely

1. Professor Grinblatt submitted a revised version of his report on April 2, 2019. References to Professor Grinblatt's Initial Report refer to the more recent version.

different spreads on transactions, including zero and negative spreads. Professor Grinblatt's damages models instead produce unrealistic and, in some cases, inconsistent predictions about spreads and damages.

- Professor Grinblatt claims that estimates of spreads based on CMPN midquotes and pre-trade marks (PTMs) are "meaningless". Yet: (i) he relies on CMPNs for his regression analysis to infer spreads actually paid; (ii) he acknowledges that CMPN midquotes estimate true value; (iii) his regression Model VI.10, when corrected for data errors, confirms the validity of CMPNs and PTMs. Further, Model VI.9, when corrected for data errors, confirm the validity of PTMs.
- Professor Grinblatt mischaracterizes the contents of a prior academic paper I wrote with Professor Ingrid Werner, saying it is about estimating true (half) spreads. Below I explain these mischaracterizations and why the methods in my paper fundamentally differ from the regression techniques Professor Grinblatt relies upon.
- Professor Grinblatt provides no basis for his claim that his regression analysis yields estimates of the "true spread" and no answer for the fact that his regression estimates of true spreads exhibit little variation across transactions. His estimates are inconsistent with documents and testimony in this matter. CMPNs and PTMs provide plausible estimates of spreads that are consistent with academic findings, data and testimony.
- Professor Grinblatt changes the regression model in his original report, acknowledging that his original regression did not adequately estimate spreads. The multiple versions of his revised regression analyses yield results that are inconsistent

with each other. He provides no scientific basis for deciding which regression model(s) or damages estimates are appropriate.

- Professor Grinblatt's revised regression analyses continue to assume their conclusion of widespread harm.
- Professor Grinblatt claims the explanatory power of his regression model for spreads is much higher than the roughly 1% I reported. He claims this is due to several thousand data errors he now has removed, as well as an error he believes I made in formulating a spread version of his regression model. I prove unambiguously that it is Professor Grinblatt who has made the error, and that my regression model is in fact exactly the one he would have me estimate. The explanatory power of this spread model remains low, not high, as he incorrectly claims.
- Grinblatt's revised regression analysis includes new off-SEF LCH-cleared transactions. These off-SEF transactions are very different from his original off-SEF sample. No evidence is provided that the addition of these new off-SEF cleared transactions, a small subset of all off-SEF cleared transactions, solves the problem that the original off-SEF cleared sample was not representative.
- Professor Grinblatt again fails to provide a framework for estimating damages for package trades. A substantial share of the package transactions he analyzes have calculated spreads that are zero or negative.

2. The time constraint placed on this Reply makes it impossible for me to address each new claim or analysis made in the Rebuttal Reports. My work is ongoing. A list of the materials relied upon in preparation of this report is attached as Appendix A.

II. Professor Grinblatt Makes Artificial and Contradictory Attempts to Distinguish Evidence Pertaining to Impact and Damages.

3. Professor Grinblatt's Rebuttal Report offers two primary opinions: (i) all class members suffered a common economic injury ("common impact"); and, (ii) there exists a reliable, class-wide methodology for calculating damages ("class-wide damages").[2] He states that his impact and damages opinions are logically distinct and accuses Defendants' experts of "conflating" the two:

> "… I have reached my conclusion on common class-wide impact based on fundamental economic principles, empirical evidence and the documentary evidence in this matter. Simply manipulating the inputs to my damages methodology to eliminate damages for segments of the class merely produces an outcome whereby some class members may not be awarded damages, and does not refute my opinions … that all class members suffered a common impact."[3]

4. Professor Grinblatt's attempt to separate impact and damages is artificial. If his damages framework is sound and does not identify harm for specific transactions or customers, then that is evidence that should be considered in determining whether those trades and customers were harmed.

5. Professors Grinblatt and Duffie offer theoretical reasons why there is common economic injury in order to maintain their view that all customers are harmed, including those that Professor Grinblatt's methodology suggests are not. The primary ones are that the introduction of AA2A platforms would have increased liquidity, price transparency, and price "discipline" for all transactions and customers. Professor Grinblatt, for example, states that AA2A:

---

2. Grinblatt Rebuttal ¶ 7.
3. Grinblatt Rebuttal ¶ 6.

> "… would have resulted in lower bid-ask spreads for class members in the but-for world, and that this economic benefit would have been experienced by all or nearly all …"[4]

6. These theoretical arguments alone do not support the conclusion that all or nearly all class members were harmed. Although the finance literature identifies potential benefits from AA2A trading, it also identifies potential harms such as: liquidity fragmentation resulting in increased costs for trading instruments that do not make the transition to AA2A trading; leaking information about trading intentions to other market participants; and increasing transaction fees. These issues are discussed at greater length by Professors Johannes and Culp.

7. Evidence and empirical analysis in this case indicate that the spreads paid by different customers vary considerably, and that it is often possible to execute swaps at zero or negative spreads. Economic theory is not a sufficient basis for assuming common harm in the face of this evidence. Individualized inquiry and empirical analysis are necessary to determine whether, for any given swap or customer, a shift in the market towards AA2A trading would have been helpful or harmful.

8. My initial report described the need for individual analysis to determine whether particular swaps or customers could have been injured. This analysis would include examination of the transaction records of specific customers, their trading needs and strategies, and the strategies of their counterparties. The analysis would also consider the operational costs of trading swaps and the feasibility of trading those swaps on AA2A platforms. I explained in my initial report that the Named Plaintiffs provide an example of how such analysis is valuable.[5] First, the Named Plaintiffs' transactions could only be identified through analysis of individual transaction records because they traded through asset managers, who bundled their trades with

4. Grinblatt Rebuttal, ¶ 2.
5. Reiss Initial Report ¶¶ 211-225.

those of other customers.[6] Second, Professor Grinblatt provides no methodology to determine the extent to which Plaintiffs would continue to bundle transactions in his but for world.[7] Finally, nearly all of Plaintiffs' trades were executed by asset managers through off-SEF voice transactions and, as discussed in my initial report and further below, Professor Grinblatt's analysis relies on a non-representative sample of off-SEF transactions.[8]

III. Professor's Grinblatt's New Estimates of Spreads Are Implausible and Continue to Assume Common Impact by Construction.

A. Professor Grinblatt and Plaintiffs confuse alternative measures of spreads and the role of regression analysis in estimating spreads.

9. To understand why Professor Grinblatt's methodology yields implausible and unreliable estimates of spreads, it is important to understand what the term "spread" means and how it is used here and elsewhere in economic research. Professor Grinblatt and Plaintiffs conflate alternative definitions of spreads, which leads them to mischaracterize my prior research, make errors in interpreting variations in spreads, and incorrectly argue that Professor Grinblatt's analysis is consistent with the way I have analyzed spreads in the past.

10. As I discuss in my initial report (at ¶ 49-50), the word "spread" can refer to different constructs:

> "The difference between the bid and ask is termed the bid-ask "spread", i.e., SPREAD = ASK – BID. It is the cost of an instantaneous "round-trip" transaction involving a purchase and sale of the same contract…[Another] cost is that for a one-way buy or sell transaction. This cost is referred to as a half-spread, although the term need not literally mean half of the bid-ask spread. *A half spread is the difference between a purchase or sale price and the intrinsic or "true" market value of the contract…*
>
> *Participants in this matter sometimes do not distinguish between the bid-ask spread and the half-spread, referring to both as "spread". In what follows, to*

6. Reiss Initial Report ¶ 215.
7. Reiss Initial Report ¶¶ 210 & 219. Bundling transactions affect predicted spreads calculated by Professor Grinblatt because the notional value of contracts is an explanatory factor in his regression model.
8. Reiss Initial Report ¶¶ 225.

> *avoid confusion,* I will distinguish between the two by using "bid-ask spread" to refer to the difference between the ask and bid, and "spread" as shorthand for half-spread." (Emphasis added)

11. Plaintiffs in their Motion to Exclude ("Motion") and Professor Grinblatt obfuscate and mischaracterize my estimates and analyses of spreads and half spreads on numerous occasions. Appendix B describes in detail how both the Motion and Professor Grinblatt mischaracterize and misconstrue my prior research with Professor Ingrid Werner on spreads as relating to "true" values, when in fact it is about round-trip transaction costs that do not involve estimating true values.

12. Plaintiffs' Motion and Professor Grinblatt also mischaracterize and misconstrue the same paper claiming that it confirms my endorsement of Professor Grinblatt's regression as a means of analyzing half spreads and true values. As Appendix B details, my paper with Professor Werner used quantile regression to analyze the distribution of round-trip transaction costs. Professor Grinblatt instead uses ordinary least squares regression to estimate half spreads (or one-way transaction costs). These two forms of regression are very distinct statistical tools. They are used to analyze different properties of data and distinctly different spreads. Professor Grinblatt uses ordinary least squares analysis to estimate expected, or average, spreads based on the characteristics of a given swap. Quantile regression is a tool that was used in my prior research to investigate *the distribution* of (round-trip) bid-ask spreads, not *average* spreads. My article analyzed the phenomenon that Professor Grinblatt's analysis defines away – variation in trading costs across transactions. The failure to draw this distinction is either a serious oversight or a reflection of Professor Grinblatt's lack of understanding of quantile regression.[9]

9. "[C]lassical, linear regression methods … enable one to estimate models for conditional mean functions, quantile regression methods offer a mechanism for estimating … the full range of other conditional quantile functions. By supplementing the estimation of conditional mean functions with techniques for estimating an entire family of conditional quantile functions, quantile regression is capable of providing a more complete

13. Ordinary least squares regression is not an appropriate tool to develop reliable estimates of injury and damages for individual trades and class members if, as is the case here, there is evidence of considerable variation among different trades and customers based on characteristics that are omitted from the regression.

B. Professor Grinblatt's analysis assumes that comparable swaps face the same spread, and that assumption ensures his conclusion of widespread harm.

14. Professor Grinblatt's revised regression model uses ordinary least squares regression to estimate "actual world" spreads. Just as in his Initial Report, Professor Grinblatt's revised model generates estimates that are identical for observationally equivalent swaps. He assumes, for example, that all cleared on-SEF 10-year pay-fixed swaps with a notional value of $10 million in a given month paid the same spread.[10]

15. For on-SEF cleared transactions, he estimates the spreads that would prevail in the but-for world as 20% of the actual world spreads he estimates for 2013 through 2014. His 20% (or 80% compression) assumption is not a statistical estimate. Instead, it is best described as an impression that Dr. Grinblatt drew from selective case studies done by others.[11]

16. Professor Grinblatt claims the 80% compression assumption that he drew from other markets applies uniformly across all on-SEF, cleared swap transactions and should be applied to 2013/2014 spreads.[12] This compression assumption can serve to mask uninjured trades. For example, transactions with spreads that are zero or negative suffered no harm, but nevertheless under Professor Grinblatt's approach are considered damaged. By assuming that all

---

statistical analysis of the stochastic relationships among random variables." Roger Koenker, "Quartile Regression", in International Encyclopedia of the Social & Behavioral Sciences (Second Edition), James D. Wright, (Elsevier, 2015), p. 712. (Emphasis added.)

10. The section uses as an example a common 10-year contract (or "ticker"): USD SWAP SEMI 30/360 10Y. The patterns observed in the results presented here hold for any given ticker.

11. An 80% compression of a 1bp bid-ask gives a 0.2 bp spread.

12. Grinblatt Initial Report ¶ 261. The 80% assumption is applied directly to outright, on-SEF, cleared swaps and is the basis of the "arithmetic compression" that Professor Grinblatt proposes to apply to other transactions.

like swaps trade at the same spread, and that all but-for spreads can be calculated as a discounted percentage of that spread, his original and revised regression models always or almost always predict positive spreads and therefore damages.

17. Professor Grinblatt offers no corroborating documents, testimony or other evidence that this is true for swaps traded during the class period. As I noted in my initial report there are numerous documents and testimony to the contrary. Further, it is unclear why one would expect that comparable swaps would always trade at the same spread on AA2A, CLOB or RFQ platforms.[13] Just as comparable swaps trade at different spreads in the real world, there is no reason to believe the assumption his damages framework imposes – that all comparable swaps trade at the same spread in the actual or but-for worlds.

C. There is no basis for Professor Grinblatt's claim that his regression model distinguishes "true" spreads from noise.

18. Professor Grinblatt claims that his regression analysis allows him to "separate the true economic spread from this measurement error."[14] The spread for a customer purchase is:

Spread = Fixed Rate – True Rate

For a customer sale it is:

Spread = True Rate – Fixed Rate

19. The fixed rate on a contract is directly observed and generally can be measured without error. To conclude that his damages approach yields the "true economic spread", it is necessary to know the "true rate," which all agree cannot be directly observed. Professor Grinblatt can determine the "true economic spread" only if he precisely measures the "true rate" for all transactions.

---

13. Professor Grinblatt might argue that this would happen because the swaps are not identical and they cost the dealers different amounts to trade, but these differences, should they exist, are not taken into account in his regression model.
14. Grinblatt Rebuttal, ¶ 381.

20. Professor Grinblatt's regression models produce *estimates* of the actual spreads that were paid during the class period. He asserts that his regression model yields true spreads but he provides no evidence to support that claim, and his revised results establish that his earlier model yielded incorrect "true spreads". Like all estimates, his "estimated actual" spreads are measured with error, a feature shared with other spread measures or estimates (e.g., estimates such as those based on Bloomberg CMPN midquotes or pre-trade marks (PTMs)).[15]

21. The ultimate question then is, how plausible and accurate are his estimates? Professor Grinblatt does nothing to test or evaluate the plausibility and accuracy of his models' estimates. But one way of assessing plausibility is to compare these estimates to other evidence produced in this matter. As I explain below, Professor Grinblatt's estimates are not plausible by this assessment. Another way of assessing his regression estimates is to ask whether the multiple regression models Professor Grinblatt has now proposed yield similar and consistent estimates. As I explain later, they do not. Knowing that the models he estimates are different is important because Professor Grinblatt does not provide a rigorous basis for choosing among his various alternative models and methods.

D. Professor Grinblatt's Revised Regression Analyses Produce an Unrealistic Lack of Variation in Spreads.

22. In my initial report I pointed out that Professor Grinblatt's estimated spreads were unrealistic because they were never zero or negative, something market participants say often happens, and his spreads exhibited no variation for comparable transactions during a month, and little variation over a year.[16] Despite refining his regression models in his Reply, these problems persist.

15. For a discussion of Bloomberg CMPNs and PTMs see ¶¶ 40-42 and ¶ 52 of my initial report.
16. Reiss initial Report, III.C and IV.A.

23. Professor Grinblatt's revised regression analyses add explanatory variables to the damages model in his Initial Report. One principal difference is that there are now more observable characteristics (e.g., pay/receive interaction variables, and contract-specific/time fixed effects). However, by construction, his revised models continue to impose the result that spreads are identical for all transactions with the same observable characteristics. Professor Grinblatt argues that this is not "averaging", but this distinction is semantic because his approach, both in his Initial Report and Rebuttal Report, presumes that all transactions with the same observational characteristics in a month paid the same "average" spread. For example, in Professor Grinblatt's data there are [redacted] 10-year, $10 million fixed for floating swaps where the customer pays fixed and were traded on-SEF and cleared during May 2015. His revised models (e.g., IV.3 and IV.8) impose the implausible result that all of these swaps traded at precisely the same bid-ask spread. The models would impose that result even if all of those swaps actually traded at different spreads.

24. Exhibit 1 illustrates this point. It plots his revised model VI.8 estimated spreads for the aforementioned pay-fixed transactions as red dots. The blue dots are the calculated spread estimates based on the midquotes that Dr. Grinblatt derived from Bloomberg's CMPN composite data. As one can see, Professor Grinblatt's spread estimates (red dots) do not change, whereas there is considerable variation in his CMPN-based estimates of spreads, including some that are negative. While one may question the precise accuracy of the CMPN-based estimates, it is not plausible that all customers paid the exact same spread for that swap for an entire month. Further, it is important to keep in mind that Professor Grinblatt uses spreads based on CMPN midquotes (the blue dots) to calculate, via regression, the red dots.

Exhibit 1

Calculated and Predicted Spreads Based on Professor Grinblatt's Model VI.8
Representative Pay-Fixed Swap

● Calculated Spread —●— Predicted Spread

Source: Professor Grinblatt's Regression Sample (Model VI.8).
Notes: Based on on-SEF cleared USD SWAP SEMI 30/360 10Y swap with $10 million notional.

25. Exhibit 2 expands beyond May 2015 to look at all 2015 transactions for these 10-year, $10 million fixed for floating pay-fixed transactions traded on-SEF and cleared. The red dots again are Professor Grinblatt's estimates of actual spreads paid, while the blue dots are calculated spreads that reflect the CMPN midquotes underlying his estimation. The exhibit shows that Professor Grinblatt's revised model eliminates nearly all variation in spreads for this contract and notional over the course of 2015.

Exhibit 2

Calculated and Predicted Spreads Based on Professor Grinblatt's Model VI.8
Representative Pay-Fixed Swap

● Calculated Spread ● Predicted Spread

Source: Professor Grinblatt's Regression Sample (Model VI.8).
Notes: Based on on-SEF cleared USD SWAP SEMI 30/360 10Y swap with $10 million notional.

26. So when do spreads for this contract and notional vary much in Professor Grinblatt's model? Exhibit 3 extends the above exhibits to look at the period Q4 2015 to Q1 2016. Notice the discontinuity that occurs in spreads at year-end 2015. This is a consequence of the way he models spreads using four year-specific indicators (2013/14, 2015, 2016, and 2017). Much of the variation in his predicted spreads occurs because of changes across years. Once the change happens at the start of 2016, estimated spreads "paid" from his model again do not change much. The blue calculated spreads continue to exhibit substantial variation.

Exhibit 3

Calculated and Predicted Spreads Based on Professor Grinblatt's Model VI.8
Representative Pay-Fixed Swap
October 2015 - March 2016

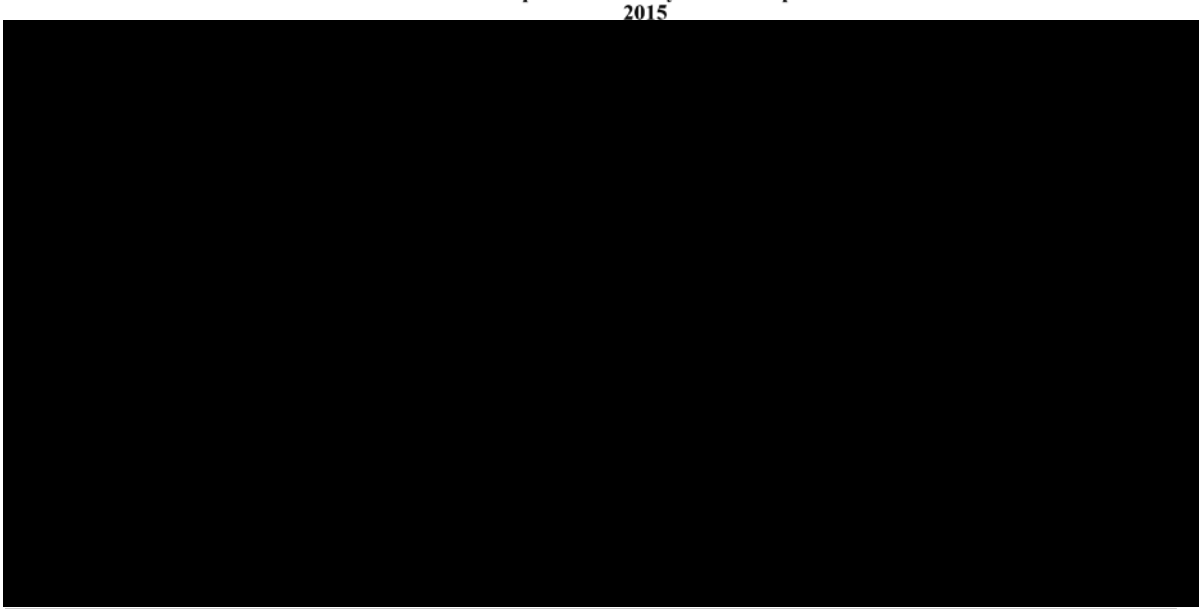
● Calculated Spread ● Predicted Spread

Source: Professor Grinblatt's Regression Sample (Model VI.8).
Notes: Based on on-SEF cleared USD SWAP SEMI 30/360 10Y swap with $10 million notional.

27. There is ambiguity in Professor Grinblatt's estimated spreads that he does not resolve. Exhibit 4 compares the predictions from the regression model in Professor Grinblatt's Initial Report and Model VI.8 (a revised model from his Rebuttal Report). As the figure shows, Professor Grinblatt's revised model yields estimates of spreads that are very different from those presented in his Initial Report.

Exhibit 4

Predicted Spreads Based on Professor Grinblatt's Opening Report Model and Model VI.8
Representative Pay-Fixed Swap
2015



● Model VI.8 ● Opening Report Model

Sources: Professor Grinblatt's Opening Report Regression Sample and Regression Sample (Model VI.8).
Notes: Based on on-SEF cleared USD SWAP SEMI 30/360 10Y swap with $10 million notional.

28. These estimates of "actual" spreads generated by Professor Grinblatt's regression model are implausible and likely to yield false positive estimates of harm. In my initial report, I cited evidence and testimony that indicate dealers vary spreads for reasons not included in his model, including customer identities, risk of the trade, the dealer's position, and market conditions. Professor Grinblatt asserts that this evidence is somehow hand-picked and non-representative,[17] but if that were true, Dr. Grinblatt presumably would have cited contrary evidence indicating that spreads uniformly do not vary according to these characteristics. He did not do so.

17. Grinblatt Rebuttal ¶ 246 ("Defendants' experts have also engaged in a one-sided analysis.")

IV. Available Data Contradict the Claim that Injury to All Trades and Customers can be Assumed Without Individual Inquiry.

29. My initial report used two alternative estimates of the spread of a swap transaction to establish that spreads on many of the transactions in Professor Grinblatt's regression data were lower than Dr. Grinblatt's regression-based estimated but-for spreads, and thus estimated to be unharmed. These two estimates were: (1) the trade-specific spreads Professor Grinblatt calculated from Bloomberg CMPN midquote estimates; and (2) spreads calculated from the pre-trade marks (PTMs) that dealers contemporaneously reported to, or were calculated by, Bloomberg and TradeWeb during the class period. These analyses identified a substantial number of unharmed swap transactions based on several alternative "but for" benchmarks, including Professor Grinblatt's but-for spreads and the minimum spread (i.e., tick size) available on trueEX, TeraExchange, and Javelin.

30. Professor Grinblatt has revised his data and his regression models. The revised data and models in his Rebuttal Report indicate an even larger percentage of "unharmed" transactions as measured by the calculated spread estimates. The revised data and models also indicate large numbers of "unharmed customers" based on the customers and transactions in Professor Grinblatt's data. These results demonstrate that it cannot be assumed on the basis of economic theory or academic literature that all or nearly all trades and customers would have been harmed by the alleged conspiracy. These results also show why individualized analysis is required to identify harm.

31. Professor Grinblatt, however, argues that these results should be discarded based on an assumption that they are entirely attributable to noise or measurement error. He also argues that I have incorrectly represented these two estimates of actual world spreads as perfect estimates. These claims are misleading and incorrect. My initial report identified these spread

estimates as exactly that – estimates. Although these calculated spreads are estimates, and thus like Professor Grinblatt's regression estimates are measured with error, they provide valuable information. Indeed, Professor Grinblatt relied on the CMPN midquote and calculated spread estimates multiple times in his damage analysis. Professor Grinblatt cannot both claim the CMPN-based midquotes and spreads are meaningless and at the same time use them as a basis for estimating his damages model. I now discuss these points in greater detail.

A. Professor Grinblatt's calculated spreads indicate that many transactions were unharmed.

32. A substantial share of the spreads calculated by Professor Grinblatt based on CMPN midquotes are below zero for the transactions in his regression data, and greater shares are below Professor Grinblatt's estimate of but-for spreads, as well as other benchmarks used in my initial report. Indeed, the share of transactions that are unharmed in Professor Grinblatt's revised data are even larger than in the original data used in his Initial Report.

33. Exhibit 5 reports results for three different sets of transactions in Professor Grinblatt's regression data:

- A "customer sample" that includes off-SEF transactions cleared by LCH, but excludes transactions that involve defendants' and their affiliates as customers.[18]
- Professor Grinblatt's "regression sample" that excludes the transactions he discarded as "outliers," including many excluded arbitrarily because they have high or low calculated spreads. This alternative is less informative than the other sets.

18. As discussed in my initial report ¶ 154, transactions in which customers are affiliated with dealers are not part of the proposed class and thus are appropriately excluded from the analysis.

- Professor Grinblatt's off-SEF transactions, including those Professor Grinblatt derives from new off-SEF LCH-cleared swaps.

Exhibit 5

Shares of Transactions With Calculated Spread Below Alternative Thresholds
Using CMPN Midquote

		Threshold		
	Trades	Less than or Equal to 0	Less than or Equal to But-For Spread	Less than or Equal to Alternative But-For Spread
Customer Sample	[redacted]	[redacted]	[redacted]	[redacted]
Professor Grinblatt's Regression Sample	[redacted]	[redacted]	[redacted]	[redacted]
Off-SEF Customer Sample	[redacted]	[redacted]	[redacted]	[redacted]

Source: Professor Grinblatt's backup.
Notes:
[1] Customer Sample includes all transactions for which Professor Grinblatt was able to match CMPN midquote, applying all his exclusions except: trades with crossed CMPN quotes, top and bottom 5% of trades, and LCH trades with calculated spreads below [redacted] or above [redacted] Customer Sample excludes trades with co-defendants.
[2] Professor Grinblatt's Regression Sample based on Model VI.8.
[3] But-for spread based on Professor Grinblatt's Model VI.8.
[4] Alternative but-for spread assumes linear compression starting January 2014 and reaching 70% on December 2017.

34. Results for the customer sample indicate that [redacted] of transactions have zero or negative spreads and fully [redacted] are below Professor Grinblatt's but-for spreads. In addition, if we relax Professor Grinblatt's 80% compression assumption to an assumption of 70% compression that phases in from January 2014 through December 2017, the percentage of uninjured transactions rises to [redacted]. For the off-SEF sample, we also see [redacted] of transactions below Professor Grinblatt's but-for spreads.[19]

35. These empirical findings contradict Plaintiffs' experts' theoretical conclusion that all or nearly all trades and customers were harmed by the alleged conspiracy. How can we presume that all customers were harmed in the face of evidence indicating that significant

19. The but-for spread in this calculation is based on arithmetic compression as defined by Professor Grinblatt.

numbers of trades were executed at spreads of zero, at negative spreads, or at spreads lower than Professor Grinblatt's estimates of but-for spreads? We cannot.

B. Professor Grinblatt's calculated spreads indicate that many customers were unharmed.

36. While spreads based on Bloomberg CMPN midquotes are only estimates of true spreads, it is impossible to dismiss the observed variation in spreads as the product of "noise" alone, especially in light of testimony and documents produced by market participants that confirm the existence of substantial variation in spreads across customers and transactions.[20] This again indicates that theory and academic literature do not provide a sufficient basis for presuming harm to all or nearly all transactions and class members. Recognizing that spreads are estimates, at a minimum these estimates demonstrate a need for individualized inquiry into the claims of harm to particular transactions and customers.

37. Analysis of customer-level harm due to the alleged conspiracy is complicated by the small and unrepresentative scope of transactions in Professor Grinblatt's sample.[21] Nonetheless, it is possible to explore what his data imply about the extent of customer-specific harm for samples of transactions he analyzes. Indeed, Professor Grinblatt does just this. He reports the results of such a customer-level analysis of harm based on the "predicted actual" spreads that he estimates.[22]

38. This section addresses the same question using CMPN-based spreads calculated by Professor Grinblatt and his revised model and data. As above, results are reported for the

---

20. Section IV.A.2 of my initial report summarizes documentary evidence of the variation in spreads across transactions and customers. Exhibit IV.1 of that report shows that the distribution of spreads for JPMorgan trades in 2013 reported in an "ordinary course" document is similar to that calculated from the 2013/14 regression data used in Professor Grinblatt's regression sample from his initial report.

21. Appendix C to my initial report shows that Professor Grinblatt's analysis is based on a sample of swap transactions that account for less than 5% of the notional value of all swaps transacted between 2013 and 2017. The same is approximately true of his refined sample.

22. Grinblatt Rebuttal, ¶¶ 453-4.

customer sample. The analysis uses Professor Grinblatt's estimate of "but for" spreads as well as alternative benchmarks to identify unharmed customers and transactions. Net damages for each customer are calculated as the sum of spread inflation for each of the customer's transactions weighted by notional amount and Professor Grinblatt's DV01 factor.

Exhibit 6

Unharmed Customers Using Calculated Spreads

Using CMPN Midquote

	Threshold		
	Less than or Equal to 0	**Less than or Equal to But-For Spread**	**Less than or Equal to Alternative But-For Spread**
All Swaps Unharmed	[redacted]	[redacted]	[redacted]
Unharmed on Net	[redacted]	[redacted]	[redacted]

Source: Professor Grinblatt's backup.

Notes:

[1] Based on [redacted] customers in Customer Sample, which includes all transactions for which Professor Grinblatt was able to match CMPN midquote, applying all his exclusions except: trades with crossed CMPN quotes, top and bottom 5% of trades, and LCH trades with calculated spreads below [redacted] or above [redacted]. Customer Sample excludes trades with co-defendants.

[2] But-for spread based on Professor Grinblatt's Model VI.8.

[3] Alternative but-for spread assumes linear compression starting January 2014 and reaching 70% on December 2017.

39. As shown in Exhibit 6, the results indicate that [redacted] of customers in these data were not "harmed" on any transaction and that [redacted] of customers were unharmed on a net basis. Of the [redacted] customers in Professor Grinblatt's data, the results indicate that [redacted] executed all of their transactions at spreads below or equal to zero and [redacted] customers executed all transactions at spreads below Professor Grinblatt's but-for level.

C. Professor Grinblatt's extensive use of CMPN Midquotes establishes that they provide valuable estimates of mids and spreads.

40. Professor Grinblatt argues that analyses of individual transaction spreads using Bloomberg CMPN midquotes are "largely meaningless."[23] He argues that such analysis "implicitly assumes that the CMPN Midquote unerringly equals the 'true rate.'"[24] Similarly, Plaintiffs' Motion argues that my analysis treats "the Bloomberg Composite mids as perfect measures of the true market midpoint …"[25] These statements are incorrect.

41. My initial report stated that "[t]he Bloomberg composite data used by Professor Grinblatt to calculate the transaction-specific mids for his Regression Dataset yield a transaction-specific *estimate* of actual spreads."[26] More fundamentally, Professor Grinblatt's statement falsely suggests that the presence of "noise" in data necessarily invalidates statistical or econometric analysis. If so, then virtually all economic analyses – including Professor Grinblatt's – would need to be rejected as unreliable. Most economic data are subject to various degrees of measurement error.

42. In the current context, the relevant question is whether spreads calculated with CMPNs (or PTMs) provide useful information in answering the question of whether individualized inquiry is necessary to determine whether individual trades and customers could have been harmed by the alleged conspiracy. They do. The CMPN-based estimates are clearly useful and cannot be dismissed as meaningless noise. Professor Grinblatt does not argue CMPN estimates of midquotes are biased (e.g., that they systematically over- or under-state true

23. Grinblatt Rebuttal, ¶ 385.
24. Grinblatt Rebuttal, ¶ 385.
25. Motion to Exclude p. 4.
26. Reiss Initial Report, ¶ 72, emphasis added. See also, Reiss Deposition at 39:15-20 ("So the true value of an interest rate swap. Again, I think that's something that is going to be estimated.")

value).[27] Indeed, his use of them in his regressions presumes they are unbiased.[28] It is possible, of course, that any particular CMPN midquote is randomly below the true value or above the true value. While such noise in estimates of true spreads can result in "false positive" conclusions about unharmed transactions, unbiasedness implies noise also can result in "false negative" conclusions as well. Professor Grinblatt provides no reason to believe that the incidence of uninjured transactions and customers would go down rather than up if noise and measurement error could be eliminated.

43. Professor Grinblatt makes extensive use of the trade-specific spreads that he calculated using CMPN midquotes. By doing so, he acknowledges that the CMPN midquotes provide useful estimates of the spreads on individual transactions notwithstanding any measurement error in these estimates. He also explained in his report why he regards the Bloomberg CMPN data as reliable. For example:

- He states that "Bloomberg is a widely used third-party vendor of IRS quote data relied on by investors, dealers, regulators and academics to make trade decisions, conduct research studies, and learn about the IRS market." (Grinblatt Initial Report Appendix 3, ¶ 3.) He adds that the Bloomberg CMPN data in particular are based on "indicative quotes from a set of dealers whose quotes have previously been screened by Bloomberg for reliability"; that Bloomberg "ensure[s]" that the data reflect "the best contemporaneous information" by excluding information that is more than thirty seconds old; and that each

27. As discussed in my initial report, Professor Grinblatt's claims that PTMs are biased are largely based on PTMs for [redacted] trades. He does not provide evidence of anomalies in or dispute other dealers PTMs. In my report, I showed that my conclusions about spreads calculated using PTMs hold whether or not one includes [redacted] PTMs. Reiss initial report, ¶ 171.

28. Were they not unbiased, he could not argue his regression estimates delivered consistent estimates of his coefficients and ultimately spreads.

contributing dealer "must pass through an observation period when its quotes are evaluated for quality, consistency and consensus with the market." (Grinblatt Report ¶ 217 and footnote 221.)

- He explained that "the 'true rate'" of an interest rate swap is "typically … taken to be the mid-quote prevailing at the time of the trade." (Grinblatt Report ¶ 223.) He determined that "when data on bid and ask quotes are available, the effective spread paid by an investor on an IRS transaction can be measured as the difference between the [transaction rate] … and the prevailing mid-quote..." (Id. ¶ 212.) He therefore "use[s] the Bloomberg mid-quote (*i.e.*, the average of bid and ask quotes) as the measure of the 'true rate.'" (Id. Appendix 5 ¶ 52.)
- Professor Grinblatt uses the spreads he calculated from CMPNs to eliminate what he calls "outlier" transactions (those which have spreads that are particularly high or low) from his regression analysis. He can use calculated spreads in this way only if he can rely on them to say what is unusual.
- Professor Grinblatt uses these spreads to calculate a CME-LCH basis adjustment for transactions cleared at CME. This basis adjustment attempts to correct for differences in fixed rates for identical contracts cleared through CME and LCH. Professor Grinblatt explains that he calculates "the basis by calculating the daily average difference between CME transaction rates and the preceding Bloomberg mid-quotes for every instrument and every trading day."[29] Again, his use of CMPN midquotes for this purpose shows he believes that they provide valuable information about the true spreads on individual transactions.

29. Grinblatt Initial Report, Appendix 5, ¶ 39.

- Professor Grinblatt uses CMPNs in his original rate regression analysis to explain variation in fixed rates. This regression establishes that a [redacted] change in the mid translates to a nearly identical [redacted] change in fixed rates. His Rebuttal Report focuses on this [redacted] both to establish the reliability of CMPNs and in attempting to establish that PTMs are not reliable.[30] I discuss below the errors in the particular way that Professor Grinblatt went about this analysis, but the fact that he conducts the analysis confirms that he believes the CMPN data provide a useful means of estimating the "true mid" and the "true spread" of a swap.
- Professor Grinblatt's Rebuttal Report uses CMPN midquotes in the spread versions of his regression damages models. He could not properly do so if they did not provide valuable information about the spreads on individual transactions.

44. Professor Grinblatt's reliance on CMPN midquotes and the associated spreads confirms that they provide valuable information for purposes of estimating true values and spreads on individual transactions. Just as it makes sense for Professor Grinblatt to use estimates of true values based on CMPN midquotes throughout his analysis, so too does it make sense to use CMPNs to investigate unharmed transactions.

45. As noted above, Exhibits 5 and 6 show that [redacted] of the customer (i.e., non-defendant) transactions in Professor Grinblatt's regression data were unharmed compared to his estimate of but-for spreads, that [redacted] of the [redacted] customers were unharmed on any of their transactions and that [redacted] of customers suffered no net harm. Professor Grinblatt cannot dismiss results of this magnitude as meaningless noise:

30. Grinblatt Rebuttal, ¶¶ 439-443.

- First, whether or not these estimates are precisely accurate in individual instances, they provide a strong indication that the proposed class includes significant numbers of uninjured trades and customers. Only individualized inquiry would give us the means to know what is noise and whether noise has overrepresented or underrepresented unharmed trades and customers.
- Second, a large amount of real-world evidence reviewed in my initial report indicates that zero-spread and negative-spread transactions are not just noise. This evidence includes an ordinary course business document that generates results generally in line with the results produced by the CMPN data.[31]

46. The significant numbers of uninjured trades and customers reflected in the CMPN-based estimates establishes that economic theory and academic literature alone are not a sufficient basis for presuming harm to all or nearly all customers. Instead, individual analysis of transaction records, market conditions, and the circumstances of particular transactions and customers are necessary to determine whether the observed variation in spreads across transactions and customers are accurate or whether they can be attributed to noise and measurement error. This individualized inquiry cannot be confined solely to trades and customers that the estimates initially identify as "uninjured." This is because noise and measurement error could result in either understatement or overstatement of uninjured trades and customers.

D. PTMs are reliable under the criteria established by Professor Grinblatt.

47. My initial report also evaluated the pre-trade mark or "PTM" estimates that dealers provided to customers in connection with price quotes they received on SEFs. PTMs

31. Reiss Initial Report ¶ 148 & Exhibit IV.1.

provide alternative estimates of true values and thus potentially are of value in establishing the reliability of my analysis of spreads. My analysis of PTMs yielded results that were similar to those based on CMPN midquotes, albeit they indicated a slightly smaller frequency of unharmed transactions. As with CMPN midquotes, Professor Grinblatt misleadingly claims that I assumed that PTMs unerringly measure the "true rate" or true value of a swap.[32] I explicitly acknowledged that they were dealer estimates or SEF estimates of true values, not perfect measures.

48. My initial report provided evidence that the distribution of spreads based on CMPN midquotes and PTMs was consistent with documents and testimony produced in this matter. Professor Grinblatt's Rebuttal introduces another way of evaluating the reliability of spread estimates based on CMPNs and PTMs. He does this using his regression model. He claims that if they reliably estimate the true rate, they should have [redacted] with the negotiated fixed rates in swap contracts. I noted in Section IV.C above that he finds that CMPN midquotes when entered in his rates regression analysis yield a [redacted] with fixed rates.

49. To test the reliability of PTMs, Professor Grinblatt replaces CMPN midquotes with PTMs in his regression model. His hypothesis is that if PTMs are meaningful, they should also have [redacted] Table VI.9 in his Rebuttal Report shows a weaker relationship between PTMs and fixed rates, with a [redacted] change in PTMs associated with a [redacted] change in the fixed rate.[33] On this basis, he concludes that PTMs are not as reliable as CMPNs.

50. In a related test presented in his Table VI.10, he includes both the PTM and CMPN midquote in the same regression. His implicit hypothesis is that if both have the same

32. Grinblatt Rebuttal ¶ 385.
33. Grinblatt Rebuttal ¶ 441.

information, then they should have equal explanatory effect. He reports that this regression yields [redacted] between CMPNs and fixed rates, and [redacted] between PTMs and fixed rates.[34] He concludes that "[t]he PTMs are not a reliable measure of the true rate."[35]

51. Professor Grinblatt's PTM analyses and conclusions are flawed and unreliable. His results reflect errors in data construction. When these errors are corrected, his analysis shows that PTMs are just as reliable as CMPNs using his criteria.

52. Most PTMs and fixed rates contained in the Bloomberg and TradeWeb data are reported as percentages (e.g., 2.011%). However, for some transactions in his sample, PTMs are reported in basis points (e.g., 201.1 bp). Although my original PTM analysis identified and removed these basis point transactions to prevent them from distorting results, Professor Grinblatt inappropriately includes these transactions when he tests the performance of PTMs. The resulting mismatch introduces measurement error in PTMs that greatly distorts his results. It is hard to understand why Professor Grinblatt would include these basis point transactions even though I identified and removed them in my original PTM analyses.

53. There are [redacted] transactions with this problem. I identified another [redacted] that have a reported PTM [redacted]. (To be clear, it is not that these four PTMs imply a *spread* [redacted], it is that the PTM for the swap fixed rate *itself* was reported [redacted]) Exclusion of these [redacted] transactions that Professor Grinblatt fails to identify and exclude dramatically changes his estimates: As shown in Exhibit 7, now there is a [redacted] between PTMs and rates – just as Professor Grinblatt found between CMPNs and rates.

34. Grinblatt Rebuttal ¶ 442.
35. Grinblatt Rebuttal Section VI.C.1.

Exhibit 7

Sensitivity of Professor Grinblatt's Model VI.9 to Outliers

	PTM Coefficient		Regression Fit	
Data Sample for Regression	Coeff.	T-Value	Adj. R^2	Number of Transactions
Professor Grinblatt's Model VI.9	[redacted]	[redacted]	[redacted]	[redacted]
After Excluding Outliers	[redacted]	[redacted]	[redacted]	[redacted]

Source: Professor Grinblatt's Regression Sample (Model VI.9).
Notes:
[1] Outliers include [redacted] and [redacted] swaps with fixed rate and PTM measured in different units.

54. Exhibit 8 reports summary regression coefficients for a regression analogous to Professor Grinblatt's Model VI.10 that includes both PTMs and CMPNs. Originally, Professor Grinblatt obtained a [redacted] coefficient on CMPNs and a [redacted] coefficient on PTMs. After one drops the outliers and transactions cleared on CME, the regression yields roughly the same coefficients on the two measures, [redacted] and [redacted] (that together sum to roughly one).[36] Thus, according to Professor Grinblatt's regression model and his criteria for evaluating estimates of true values, PTMs contain information similar to the CMPNs that Professor Grinblatt relied upon in estimating his regressions.

36. Professor Grinblatt uses rates after his CME-LCH basis adjustment as his dependent variable. Since most PTMs already incorporate any CME-LCH basis, using this adjusted rate introduces noise not present in actual unadjusted fixed rates. Exhibit 8 reports a version of this regression which excludes CME-cleared transactions in addition to the PTM outliers discussed above.

Exhibit 8

Sensitivity of Professor Grinblatt's Model VI.10 to Outliers and CME-Cleared Swaps

	CMPN Mid Coefficient		PTM Coefficient		Regression Fit	
Data Sample for Regression	**Coeff.**	**T-Value**	**Coeff.**	**T-Value**	**Adj. R^2**	**Number of Transactions**
Professor Grinblatt's Model Model VI.10	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
After Excluding Outliers	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
After Excluding Outliers and CME-cleared Transactions	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Source: Professor Grinblatt's Regression Sample (Model VI.10).
Notes:
[1] Outliers include [redacted] and [redacted] swaps with fixed rate and PTM measured in different units.

55. In sum, the criteria used by Professor Grinblatt for evaluating the reliability of midquotes indicate that PTMs are as reliable as CMPNs. This adds to the evidence cited in my initial report indicating that the PTMs contain valuable information for purposes of evaluating spreads on individual transactions, evaluating the implausible estimates generated by Professor Grinblatt's regression models, and evaluating whether the alleged conspiracy would have harmed all trades and customers. I have evaluated the reliability of these data using widely accepted statistical methods, including those used by Professor Grinblatt, and concluded that, while imperfect estimates, they are reliable for the purposes for which I have used them. Correcting Professor Grinblatt's analyses shows that he has not provided any evidence that they are unreliable for those purposes.[37]

56. Professor Grinblatt's argument that the CMPNs and PTMs yield imperfect estimates of mid and spread apply with at least as much force to his own regression models.

[37] Although Professor Grinblatt previously suggested that dealers might have skewed their PTMs to make trades look more appealing, there is no obvious motive to do so. PTMs were provided in conjunction with SEF trades, and customers that trade on SEFs ordinarily receive three or more competing price quotes from dealers along with any PTMs that accompany those quotes. Quoting a skewed mid would not change the fact that the customer has three different prices from which to choose. Customers would presumably consider price rather than PTMs in deciding which quote to accept. In addition, as explained in my initial report, the data indicate that compared to CMPN mid-quotes, PTMs tend to *overstate* the spreads that were quoted to customers, not to understate them. See Reiss Initial Report, IV.C.3.

Those models generate estimates – not perfect measurements – of the true spreads and true mids that existed in the actual world. Moreover, as shown previously, his models make the implausible prediction that customers paid exactly the same spreads on comparable swap contracts traded in the same month. There is no evidence to support this extreme assumption and a large amount of evidence that refutes it.

E. Professor Grinblatt's approach is heavily skewed against finding unharmed transactions.

57. Modest modifications to Professor Grinblatt's revised damages methodology provide further confirmation that injury to all or nearly all trades and customers cannot be assumed without individualized inquiry. As discussed elsewhere, Professor Grinblatt's framework is heavily skewed against unharmed transactions. First, by construction Professor Grinblatt's framework imposes the requirement that all customers paid the same spread on all swaps of a given type and notional that were traded in a given month. Second, Professor Grinblatt assumes that all swaps would benefit from a large and immediate decline in his but-for world. Specifically, he assumes that all cleared on-SEF swaps would have traded at spreads 80% below the "actual" spreads that his model estimates for the 2013-2014 period. He makes a similar arithmetic compression assumption for off-SEF and non-cleared trades. Third, Professor Grinblatt discards the 5 percent of transactions with the highest and lowest spreads as reflected in his CMPN-based estimates of trade-specific spreads. The discarded lower 5% includes transactions more likely to have been unharmed compared to Professor Grinblatt's but-for spreads.

58. Taken together, these factors generally average away or conceal the existence of "uninjured" transactions. Nonetheless, Professor Grinblatt's revised models and data still identify a material number of uninjured transactions. For example, Professor Grinblatt's

methodology estimates that approximately 800 of the transactions in his revised regression data were executed at spreads less than or equal to his but-for spread. In addition, if we take the modest step of relaxing Professor Grinblatt's but-for world compression assumption from 80% to 70% and phase in this compression at a linear rate from January 2014 to December 2017, then Professor Grinblatt's methodology indicates that nearly 28,000 transactions were unharmed – more than 16% of the total.[38]

59. Focusing just on off-SEF transactions in Professor Grinblatt's revised dataset, this framework implies that over 31% of transactions would be unharmed under this alternative but-for methodology.

V. Professor Grinblatt's Calculations Overstate the Performance of his Regression Model.

A. Professor Grinblatt overstates the fit of his regressions.

60. Professor Grinblatt claimed in his Initial Report that his regression framework explained more than 99% of the variation in the negotiated fixed rates of swap contracts in his sample. I explained in response that the reliability of his model is better discussed in terms of how well it explains variation across transactions in the *spreads* in his regression data, not the *fixed rates* in the data. Because fixed rates necessarily have a close relationship to true value, nearly all of the explanatory power of Professor Grinblatt's model is attributable to his use of the CMPN midquotes as an explanatory variable. The fact that midquotes are higher (lower) in periods when fixed rates are higher (lower) is of little significance for evaluating the reliability of Professor Grinblatt's framework for estimating actual and but-for *spreads*. I re-estimated Professor Grinblatt's regression model using spreads as the dependent variable and found that his model explains a little more than 1% of the variation in calculated spreads.

38. This calculation is based on Professor Grinblatt's Regression sample and results from his Model VI.8.

61. Professor Grinblatt now argues that my analysis understates the explanatory power of his regression model due to: (i) what he calls errors in my spread reformulation of his regression, and (ii) errors or "anomalies" in several thousand transactions in his data. He claims that fixing these "errors" and revising his model allows the model to explain nearly 50% (or half) of the overall variation in the calculated spreads in his regression data.[39]

62. Regarding Professor Grinblatt's data errors, he now has determined that his sample incorrectly matched midquotes for 83 fixed-for-floating swaps (which are expressed as percentage rates) with negotiated prices for MAC swaps (which are expressed in dollars).[40] He now excludes all MAC swaps. He also excludes another 3,700 transactions because the CMPN midquotes were "crossed" on many transactions or because these swaps had "custom" features.[41] Simply removing these observations can artificially mask variation in spreads and potentially creates a sample selection (or non-representative sample) problem. But, for the purposes of the following analysis, I maintain these exclusions in evaluating Professor Grinblatt's other claims.

63. Professor Grinblatt's claim that I made implementation errors in re-estimating his model using spread as the dependent variable are unfounded and incorrect. The proof is that the re-estimated model he says is wrong in fact exactly reproduces the coefficients in his regression and exactly reproduces his spread predictions. Appendix C explains Professor Grinblatt's error and the equivalence of the coefficient and predictions from his spread regression and my spread version of his regression. Despite this equivalence, I show that his analysis overstates the explanatory power of his regression because he does not (as I do) use his model to explain

39. Grinblatt Rebuttal ¶ 479.
40. Grinblatt Rebuttal ¶ 406.
41. Grinblatt Rebuttal ¶ 406-8 and Reiss Initial Report ¶¶ 235-6.

spreads as the term is defined by practitioners and researchers. That is, Professor Grinblatt's regression model explains the variation in something other than spreads.

64. The explanatory power of a regression is sometimes measured through the R^2 (or the "R-squared") statistic. This statistic measures the share of the variation in the dependent variable that is explained by the explanatory variables in the regression. Exhibits 1 and 2 above provide some intuition about R^2 and why the explanatory power of Professor Grinblatt's revised regression models remain low, and why his claim that his model explains nearly 50% of the variation in spreads is not credible. These exhibits show that variation in his predictions of spreads (the red dots) is small relative to the variation in calculated spreads (the blue dots). If the R^2 was high, the predicted spreads (red dots) would align more closely with the calculated spreads (blue dots). They do not, and instead his predicted spreads hardly vary at all.[42] So how does Professor Grinblatt find that his model explains nearly half the variation in the blue dots?

65. The nearly 50% R^2 Professor Grinblatt claims is for a regression model where the dependent variable is NOT spreads! The standard convention in the finance literature and among practitioners is to calculate spreads directionally, with spreads typically expressed as positive numbers whether customers are buying or selling. Under this conventional approach:

- if a customer is buying a pay-fixed swap: SPREAD = RATE – TRUE PRICE
- if a customer is selling a pay-fixed swap: SPREAD = TRUE PRICE – RATE

66. Professor Grinblatt *does not follow this convention* and instead defines the dependent variable for <u>all</u> transactions as:

- Grinblatt Model "SPREAD" = RATE – TRUE PRICE

42. If the red dots were in a perfectly straight line, then R^2 would be zero.

67. Under this approach, spreads are correctly calculated and generally positive numbers for customers that buy pay-fixed swaps. However, his dependent variable is the ***negative*** of the spread for customers that sell pay-fixed swaps. Thus, his dependent variable is not spreads but an unconventional mixture of positive and negative spreads. Measuring the R^2 for this mixture is not relevant. Nevertheless, Professor Grinblatt leads us to believe his R^2 is for a model of spreads as conventionally defined.

68. Professor Grinblatt includes in his regression explanatory variables that identify the direction of the trade. Because of this, his version and my version of the regression turn out to have identical coefficients and predicted spreads. (See Appendix C.) However, because his dependent variable is not spreads but rather an unconventional combination of spreads and negative spreads, the models yield dramatically different R^2 measures. My spread model's R-squared is about 10%, and his are between three to four and a half times larger (depending on the model).[43] While Professor Grinblatt's failure to apply the standard definition of spreads artificially exaggerates the true explanatory power or "fit" of his model, it does not change the coefficients on his explanatory variables because of his inclusion of variables that identify trade direction.

69. Exhibit 9 provides another means of reconciling the different R-square measures. The first entry, 41.1%, is the R^2 from a model that uses Professor Grinblatt's unconventional dependent variable mixing positive and negative spreads; the data used to estimate this model include, as Professor Grinblatt does, both pay-fixed and receive-fixed transactions. Also, in the first row of the table are R^2 measures for the same regression, only now the model is estimated

43. The R^2 of 10% from my model is greater than that estimated based on the same model with data from Professor Grinblatt's initial report due to his exclusion of several thousand "outlier" transactions from his sample. As noted, many of these exclusions are questionable and artificially increase the explanatory power of the model. But I maintain these exclusions here for the purposes of highlighting Professor Grinblatt's error.

separately for pay-fixed and receive-fixed transactions. Intuitively, by dividing the data into separate pay-fixed and receive-fixed samples, the dependent variable for the separate samples are now spread.[44] Indeed, the last two columns in the first row report R^2 of 10.0% and 10.0% for the separate samples, showing that Professor Grinblatt's unconventional combination of positive and negative spreads has inflated his R^2 by a factor of 4.

70. For completeness, the second row of the table reports the R^2 for the spread regression specification I used in my initial report. It shows that no matter whether the pay-fixed and receive fixed samples are combined or separated, the answer is the R^2 is about 10%.[45]

Exhibit 9

Comparisons of R^2 for Alternative Regression Specifications

	R^2		
Specification	**All Transactions**	**Pay-Fixed Only**	**Receive-Fixed Only**
Professor Grinblatt's Model VI.2	41.1%	10.0%	10.0%
Spread Model (Professor Reiss)	10.1%	10.0%	10.0%

Source: Professor Grinblatt's Regression Sample (Model VI.2).
Note: Spread model reflects specification in Exhibit III.8 of Professor Reiss's Initial Report excluding CMPN Midquote as explanatory variable.

71. As reported above, the version of Professor Grinblatt's model that properly uses spreads as the dependent variable yields an R^2 of 10.1% while Professor Grinblatt's improper version yields an R^2 of 41.1%. But, when his regression is done separately for pay-fixed and receive-fixed transactions, effectively undoing his unconventional dependent variable, both the corrected version and Professor Grinblatt's version yield identical R^2 values of only 10%. As

44. This is because the minus sign on dependent variable in the receive sample is simply absorbed by the coefficients. The minus sign in this disaggregated case does not impact R^2.
45. In my Initial Report, I stated the R^2 for the spread version of Professor Grinblatt's model was about 1%. It is higher here because I use Professor Grinblatt's new data where he has removed an additional several thousand "outliers"; the removal of these observations mechanically improves the reported fit.

this indicates, the higher R^2 for his combined model is driven only by his unconventional dependent variable construction. His version inappropriately and misleadingly exaggerates the explanatory power of his model by a factor of four.

72. In sum, there is no basis to Professor Grinblatt's claim that my "reformulation of [his] regression model is incorrect." To the contrary, it is Professor Grinblatt who made a basic error. He fails to grasp that the R^2 statistic generated by his regression overstates the true explanatory power of his model. He also fails to grasp that both his version of the regression and mine generate the same estimated coefficients and predicted spreads. This is illustrated in Exhibit 10 which compares Professor Grinblatt's model and my conventionally-specified version of that model.[46] As the exhibit shows, both Professor Grinblatt's model and my spread version of it yield precisely the same estimates of effective spreads for the "median swap" for each category of swaps in each year. Appendix C provides further details and shows mathematically how and why these two models' coefficients are related.

46. For complete comparability between models, the version of my spread model reported here does not include the mid as an explanatory variable. This inclusion of this variable has no material impact on the results.

Exhibit 10

Effective Spread Estimates for "Median" Swap
Assumed Median Swap Characteristics:
Pay-Fixed, $10 Million Notional, 5 Year Tenor, 76 Trade Intensity

Note: Spread model reflects specification in Exhibit III 8 of Professor Reiss's Initial Report excluding CMPN Midquote as explanatory variable

B. Professor Grinblatt's regression framework does not yield statistically reliable estimates of spreads and compression.

1. Professor Grinblatt's regression model omits key factors affecting spreads, a fact that he directly acknowledges.

73. Professor Grinblatt claims that his regression model allows him to "separate the true economic spreads from measurement error." To draw this distinction, his regression must identify and properly account for all economic factors that influence spreads. If the regression does not do so, then: (i) variation in spreads that is not explained by the regression will reflect both measurement error and factors omitted from the regression; and (ii) the regression will not necessarily generate reliable estimates of the "true economic spread."

74. Professor Grinblatt recognizes potential distortions introduced by omitted variable bias and invokes them in responding to analyses presented by Professor Johannes and myself. These analyses showed that adding customer-specific variables to his regression model resulted in statistically significant increases in the explanatory power of his model. He states that: "[t]heir findings could easily be accounted for by an omitted variable bias – a characteristic they omit from their controls that is correlated with client identities that could explain the customer identity effects."[47] Professor Grinblatt is arguing that *his model* suffers from omitted variable bias. I agree. In fact, I introduced these customer variables to test Professor Grinblatt's claim that his model had accounted for everything but noise. If it did, then variables associated with customer identifiers should not explain additional variation in spreads. On the other hand, if they do explain variation, then they show at a minimum that Professor Grinblatt's model omits determinants of spreads and suffers from bias.[48]

75. Professor Grinblatt claims that analysis of customer-specific effects by Professor Johannes and I "undermine each other and result in nonsensical findings."[49] There is no basis to that claim, particularly because, as the previous paragraph makes clear, the statistical significance of these customer identifiers is not at issue, as shown by both Professor Johannes' and my analyses. There is no "undermining" or conflict between the two even if the estimated customer effects differ across the analyses.

76. Professor Grinblatt's comparison of my customer analysis to that of Professor Johannes also overlooks two issues. First, as I have argued, because Professor Grinblatt's model

47. Grinblatt Rebuttal ¶ 244.
48. It is also possible they represent true customer effects. I take no position on this. I stated this in my deposition at 266:18-268:17 ("So I don't view myself as trying to fix the model in terms of coming up with the right model of customer relations. My intent is only to say: Look, what he thinks may be noise has – has things that I can identify and explain a percent of the variation in his dependent variable.").
49. Grinblatt Rebuttal ¶ 243.

is flawed, I do not interpret customer-specific effects literally; rather, I interpret them as showing that customer effects, or variables correlated with customer effects, matter generally, and that Professor Grinblatt fails to account for them. Second, Professor Grinblatt fails to note that he is comparing customer-specific "effects" from substantially different analyses. For example, my analysis combines information from TradeWeb and Bloomberg SEFs; Professor Johannes analyzes customer effects for each platform separately; my analysis uses CMPN midquotes, and Professor Johannes uses PTMs (in the specification discussed by Professor Grinblatt); and Professor Johannes and I include different sets of transactions in our regression analyses. There is no reason to expect that these analyses would yield similar estimates because they are based on different sets of customers and transactions. Further, if other important variables are omitted from Professor Grinblatt's model, then the coefficients on the customer variables do not necessarily represent an unbiased estimate of customer effects.

77. Professor Grinblatt also notes that my analysis did not analyze factors that affect the size of customer-specific effects for different customers, including the fact that effects are both positive and negative relative to the average customer. He seems to believe that this undercuts the value of the analysis. But it is not possible to estimate true customer-specific effects because less than 10% of all D2C transactions are used in Professor Grinblatt's analysis and because many potentially relevant customer characteristics are not identified in the data and cannot be identified without individualized inquiry. Nevertheless, both my regression analysis and Prof. Johannes' analysis demonstrate that customer identity, or variables correlated with customer identify, matter generally, and that Professor Grinblatt fails to account for them.

78. Professor Grinblatt introduces his own repeat-customer and repeat-dealer variables in his regression Models VI.4 to IV.7 in an attempt to evaluate which customers benefit

from relationships. He claims the coefficients on these two indicators imply higher spreads due to repeat business. These regressions, however, do not control for richer differences in the effects of repeat business across customers or dealers, something that my regression showed was the case. They also do not control, for example, for the prospect that customers are especially likely to trade with their most trusted dealers at times of market volatility and stress. Without such controls, Professor Grinblatt cannot reliably estimate the true effect of customer relationships.

79. Nevertheless, both Professor Johannes' and my analyses establish that incorporating information on customer identity results in statistically significant increases in the explanatory power of Professor Grinblatt's regression model. These analyses establish that Professor Grinblatt's analysis omits statistically significant determinants of spreads and, as a result, fails to distinguish "true economic spreads from measurement error."

80. My prior report identified several recognized determinants of spreads that are not included in Professor Grinblatt's regression model. Among others, these include: (i) factors relating to the customer's identity, including the customer's business relationship with a dealer and the dealer's contemporaneous perception about whether the customer raises adverse selection risks; (ii) the dealer's inventory position; (iii) whether a customer trades for their own account or through an intermediary; (iv) macroeconomic factors such as the volatility of interest rates at the time of the transaction; and, (v) the customer's need for immediacy; etc.[50] While these factors potentially can be analyzed through individualized inquiry, Professor Grinblatt's omission of these factors again implies that his model is unlikely to identify true economic spreads.

50. Reiss Initial Report ¶ 109 and ¶ 231,

81. Professor Grinblatt's Rebuttal Report evaluates the impact of other factors on spreads, including Citadel's entry and, again, whether a transaction involves a repeat dealer or a repeat customer. Professor Grinblatt concludes that each of these factors has a statistically significant impact on negotiated rates.[51] However, each of these variables is omitted from the other models he presents. Indeed, Professor Grinblatt never identifies his preferred specification, or whether any of the models he estimated is preferred, or which one he would apply in calculating damages. This matters because he has given no rigorous basis on which the Court or I could evaluate and compare his models. In particular, the omission of different significant variables from different specifications implies that none of his regression models adequately separate true economic spread from measurement error.

2. Professor Grinblatt's revised models establish that his prior analysis did not reliably "separate true economic spreads from measurement error," and he presents no basis for concluding that his new estimates do so.

82. If Professor Grinblatt's regression model incorporates all relevant determinants of fixed rates negotiated in swaps contracts, then the inclusion of additional variables that might be expected to affect spreads would not have a material effect on his estimates of effective spreads and spread compression. As discussed above, Professor Grinblatt's revised model extends that presented in his Initial Report by including ticker-specific variables for the most frequently-traded tickers and, in effect, estimating separate regressions for pay-fixed and receive-fixed transactions. The new variables together are statistically significant and add to the explanatory power of Professor's Grinblatt's model. As a result, the estimates generated by Model VI.8

51. Although he does not present the results of his Citadel analysis, his backup materials contain what appears to be this analysis. I find that the effects he reports for Citadel are significant for both pay-fixed and receive-fix transactions only in 2015. Further, including in addition a flexible set of controls that identify month-year, swap type and currency eliminates the Citadel entry effect.

establish that his earlier models did not reliably distinguish true economic spreads from measurement error.

83. The addition of these variables leads to substantial changes in estimates of the effective spread and spread compression. Exhibit 11 compares estimates of effective spreads and compression based on models VI.2 and VI.3 of Professor Grinblatt's Rebuttal Report. The model in Table VI.2 is the spread version of Professor Grinblatt's model from his Initial Report estimated with updated data that excludes outliers; the model in Table VI.3 uses the same data based on his revised specification. The figure indicates:

- For each category of swaps – on-SEF cleared, on-SEF uncleared, off-SEF cleared, off-SEF uncleared – Professor Grinblatt's original model (VI.2) yielded estimates of median spreads in 2016 that are two to three times as large as estimates from his new model.
- Professor Grinblatt's old model indicated that median spreads *fell* substantially between 2016 and 2017 in three of the four categories; his new model indicates that median spreads *rose* considerably between 2016 and 2017 in all categories.

Exhibit 11

Professor Grinblatt's Effective Spread Estimates for "Median" Swap
Assumed Median Swap Characteristics:
Pay Fixed, Ticker "USSW5", $10 Million Notional, 5 Year Tenor, 76 Trade Intensity

■ Professor Grinblatt's Model VI.2 ■ Professor Grinblatt's Model VI.3

84. Professor Grinblatt's Model VI.8 adds new data on roughly [redacted] off-SEF transactions cleared by LCH. As discussed further below, these [redacted] transactions are a small fraction of the more than [redacted] LCH transactions for which data are potentially available, and Professor Grinblatt provides no explanation for how these transactions were selected. Despite the relatively small number of LCH transactions included in his analysis, their inclusion results in substantial changes to estimates of effective spreads generated by Professor Grinblatt's model.

85. Exhibit 12 compares estimates of effective spreads generated by Professor Grinblatt's Models VI.3 and VI.8 for median off-SEF cleared transactions. The results establish that the addition of a modest number of off-SEF cleared transactions in Model VI.8 has a substantial effect on estimates of effective spreads for off-SEF transactions. The results are

dramatic for 2016, where Model VI.8 generates an estimated spread of [redacted], which is nearly ten times smaller than the estimate that excludes these transactions.

Exhibit 12

Professor Grinblatt's Effective Spread Estimates for "Median" Swap
Off-SEF Cleared
Assumed Median Swap Characteristics:
Pay Fixed, Ticker "USSW5", $10 Million Notional, 5 Year Tenor, 76 Trade Intensity

■ Professor Grinblatt's Model VI.3 ■ Professor Grinblatt's Model VI.8

86. In his Initial Report, Professor Grinblatt argued that his regression yielded estimates of the "true spread." His new results establish that those prior estimates were unreliable. How can he be sure that his new results are reliable? Professor Grinblatt presents no evidence to support the conclusion it is, or even a way to evaluate it. He has not investigated whether factors identified above, including customer effects, dealer inventory positions, and market conditions affect his results. The addition of customer effects alone to Professor

Grinblatt's Model VI.8 significantly increases the explanatory power of the model and provides direct evidence that his model omits important variables.[52]

87. The variation in compression in spreads across the tickers used in Professor Grinblatt's analysis is much wider than suggested by the measures of compression for median swaps reported above.[53] The figure also reports the decline in calculated spreads for each over the same period. The figure shows: (i) that measured compression ranged widely across tickers; and, (ii) that the compression in Professor Grinblatt's estimated spreads do not closely align with calculations based on the underlying data.

VI. Professor Grinblatt's Data and Analysis Do Not Provide a Reliable Basis for Estimating Damages for Out-of-Sample Transactions.

88. Professor Grinblatt claims that his updated data and revised regression model provide a reliable basis for estimating damages for swap transactions not in his data set. For Professor Grinblatt's model to yield reliable damage estimates for all class members, it must, among other things, be estimated using a representative sample of class member transactions. Appendix C to my initial report established that Professor Grinblatt's initial analysis relied upon a non-representative sample because: off-SEF transactions were under-represented; his model covered only 86 contracts among the thousands of types of swaps traded during the class period; packages were not included; and his analysis used data on only about [redacted] of all D2C transactions.[54] Professor Grinblatt's Reply does not challenge this estimate.

52. Addition of customer fixed effects in Professor Grinblatt's Model VI.8 is statistically significant with a p-value less than [redacted].

53. Ticker-specific compression estimates ranged from more than 100% to less than 0% and those results hold regardless of whether compression is analyzed using median calculated spreads or predicted spreads from Professor Grinblatt's regression model.

54. Reiss Initial Report, Appendix C ¶ 4. Professor Grinblatt's Bloomberg and TradeWeb SEF data identify more than 10,000 unique "securities" (e.g., swap types).

89. Professor Grinblatt claims in his reply to have "greatly expanded the sample size by including additional data from both Bloomberg and LCH" and that these additions "fully addresses Defendants' criticisms that my sample is unrepresentative."[55] In fact, Professor Grinblatt's revised data remain limited and unrepresentative, particularly for off-SEF transactions.

A. Professor Grinblatt's revised analysis is based on a more limited set of outright transactions and tickers than his prior analysis.

90. Professor Grinblatt's Initial Report utilized data on [redacted] transactions. As I show in Appendix C of my opening report, these transactions account for [redacted] of outright transactions on Bloomberg and TradeWeb over the sample period. Cleared off-SEF transactions account for roughly [redacted] and uncleared off-SEF transactions account for only [redacted] of the [redacted] transactions. The analysis in his original Report started with 86 contract types he could match to Bloomberg quote data, but ultimately because of data removal, his analyses did not include [redacted] of the 86 contract types ("tickers"). Professor Grinblatt's revised analysis now excludes [redacted] additional transactions that he now concludes are "outliers." In the process of excluding these new observations, he eliminates all data for an additional [redacted] tickers from his revised sample.

91. In addition to dropping "outlier" transactions, Professor Grinblatt adds roughly [redacted] new off-SEF transactions cleared through LCH. These transactions account for less than [redacted] of more than [redacted] LCH transactions for which LCH data are available.[56] Moreover, he is

55. Grinblatt Rebuttal ¶ 427.

56. Some of LCH-cleared transactions appear to be D2D, or involve non-US counterparties, or are already captured by Bloomberg or TradeWeb sample. Because of the volume of data and the time limit on my reply, I have not been able to process fully and evaluate the entire LCH data production.

adding fewer off-SEF transactions than are in his original data![57] Overall, Professor's Grinblatt's new sample is less than [redacted] larger than that used in his initial analysis, and still accounts for less than [redacted] of D2C swap transactions over the sample period. His new sample accounts for only [redacted] types of IRS contracts among the thousands of contracts traded during the class period.

92. Appendix B of Professor Grinblatt's Rebuttal provides a brief explanation of how he processed the LCH data. His Appendix fails to describe how the [redacted] transactions were selected from more than [redacted] transaction records produced by LCH. His backup materials contain an intermediate LCH data set containing roughly [redacted] transactions, including the [redacted] used in his analysis. But it is impossible for me determine at this time what the [redacted] transactions represent. Perhaps the [redacted] were selected because CMPN midquotes were not available for the others. If so, the expanded sample does little or nothing to inform an assessment of the reliability of the model for swaps where CMPN data are not available. For example, CMPN data are less likely to be available for customized contracts and less frequently traded contracts.

93. Professor Grinblatt's Reply and backup materials do not contain enough information for me to follow the process he used to select the new LCH data he uses, and in the limited time available to prepare this reply I have not been able to "reverse engineer" his process.[58]

57. Professor Grinblatt's initial regression analysis uses data from roughly [redacted] off-SEF cleared transactions.

58. Professor Grinblatt received the LCH data in December 2018, was unable to use it as of the time he submitted his opening report in February 2019, and then used it in his Rebuttal Report dated October 1, 2019. I may express additional opinions about this data after I have had an opportunity to consider it.

B. Professor Grinblatt's LCH sample underscores that Bloomberg and TradeWeb data are not representative of off-SEF transactions.

94. Although I cannot compare Professor Grinblatt's off-SEF LCH sample to all off-SEF trades, I can ask how they compare to the off-SEF transactions in his original sample, all of which appeared in data produced by TradeWeb. This comparison highlights dramatic differences between these samples. Exhibit 13 displays the distribution of spreads calculated by Professor Grinblatt for these two groups of cleared off-SEF transactions.[59] The exhibit shows that the roughly [redacted] off-SEF LCH spreads added in the Rebuttal Report have a much wider distribution than the original approximately [redacted] off-SEF cleared transactions found in the TradeWeb data. For example, the 25th percentile spread in the former is [redacted] versus [redacted] in the latter sample. Comparisons of these spread data further indicate that cleared off-SEF transactions on TradeWeb are not representative of the much broader universe of off-SEF transactions cleared on LCH. For example,

- [redacted] of the TradeWeb transactions have calculated spreads that are below zero while fully [redacted] of the LCH sample have spreads below zero.
- [redacted] of the TradeWeb transactions have calculated spreads that are between [redacted] and [redacted]. In contrast, only [redacted] of the LCH sample has spreads in the same range.

59. The exhibit uses a standard graphical device in statistics called a "box and whiskers" plot. The large box colored blue and gray represents the lower (25th percentile), middle (50th percentile) and upper (75th percentile) quartiles of the data. The blue area is the range of spreads between the 25th and 50th percentiles. The gray shaded region is the range of spreads between the 50th and 75th percentiles. The whiskers are the horizontal lines that extend to the left and right of the box. These lines stop on the left at the 5th percentile spread and on the right at the 95th percentile spread.

Exhibit 13

Calculated Spreads for Off-SEF Cleared Swaps in Professor Grinblatt's Sample
5th, 25th, 50th, 75th, and 95th Percentiles

Note: The ends of "whiskers" display 5th and 95th percentiles, the left and the right side of the box display 25th and 75th percentiles, and the middle line within the box displays the median calculated spread.

95. As these results show, when Professor Grinblatt added only a limited quantity of LCH data to his dataset, the amount of variation among transactions increased significantly. The results thus confirm that his data sample is non-representative. They also raise the very real possibility that if Professor Grinblatt had used a broader and more representative data sample, we would see even more variation in the data and even larger percentages of "unharmed" transactions and customers.

C. The LCH sample confirms both the unrepresentativeness of Professor Grinblatt's sample and unreliability of his model.

96. The addition of the LCH transactions results in a sharp reduction in the explanatory power of Professor Grinblatt's model. This provides a further indication of both: (i) the unrepresentativeness of the off-SEF trades on TradeWeb, and (ii) the lack of reliability of his

regression damages model. Professor Grinblatt's Models VI.3 and VI.8 are identical with the exception that the latter includes the LCH transactions. However, inclusion of those transactions reduces the (correctly measured) R^2 generated by his model from 19.8% (Model VI.3) to 10.3% (Model VI.8). This is consistent with the high variability in calculated spreads in the LCH data.

97. Professor Grinblatt claims that LCH data provide highly reliable measures of negotiated rates, noting that "LCH is in the business of offering clearing services which is predicated on having a high degree of accuracy in its business records."[60] At the same time, his analysis uses CMPN midquotes as estimates of the true rate for LCH as well as Bloomberg/TradeWeb transactions. And, while all agree that CMPNs are only estimates of the true value, there is no basis to assume that CMPN midquotes for LCH transactions are any noisier than those for Bloomberg and TradeWeb transactions.

98. Instead, a much more likely explanation of this result is that spreads in off-SEF transactions in the TradeWeb data differ from those of the LCH transactions due to important but unmeasured factors omitted from Professor Grinblatt's regression model. As discussed in Section V above, omitted variables will cause Professor Grinblatt's analysis to yield unreliable estimates of spreads.

60. Grinblatt Rebuttal, ¶ 433.

VII. Professor Grinblatt Has No Viable Methodology for Evaluating Package Trades.

99. My initial report highlighted that Professor Grinblatt's Initial Report: (i) presented an incomplete damages methodology for package trades; (ii) failed to present any methodology for packages that include both swap and non-swap components; (iii) failed to present estimates of spread inflation for packages; and, (iv) failed to present any examples of damages calculations for package trades.[61] Packages account for approximately [redacted] of on-SEF swap transactions and [redacted] of the notional value of such transactions.[62]

100. Professor Grinblatt's Rebuttal Report again fails to establish a framework for evaluating alleged damage to package trades. While he shows how he would estimate a regression and a predicted actual spread for certain types of curve and butterfly package trades, he does not explain how the "but for" spread would be calculated and translated into damages. Further, he has not proposed any damage methodology for packages that have non-swap components.

A. Professor Grinblatt again fails to provide a methodology for evaluating damages for packages.

101. Professor Grinblatt's Rebuttal proposes to estimate predicted actual spreads for curve and butterfly trades using a variation of the regression model he used to estimate actual spreads for outright transactions.[63] Professor Grinblatt estimated this new regression model using package transaction data from Bloomberg and TradeWeb. These data are a subset of all packages; they are drawn from [redacted]. He matches these packages to corresponding CMPN midquotes for the package contract.[64] My criticisms of his regression

61. Reiss Initial Report Section VI.A.
62. Reiss Initial Report ¶ 199.
63. Grinblatt Rebuttal ¶¶ 458-475.
64. His framework for estimating "predicted actual" spreads also applies only to curves and butterflies with "standard ratios" of notional values on the legs of the packages, with each of the packages selected for analysis

approach to estimating actual spreads continue to apply to the new curve and butterfly model and are discussed in Sections II and III above.

102. While Professor Grinblatt again estimates a regression to estimate "actual" spreads for curves and butterflies, he stops there. He presents no methodology for calculating "but for" spreads. He also does not say how to estimate spread inflation or use the transaction characteristics to get dollar damages. Indeed, the words "but-for" or "counterfactual" do not appear in his discussion of damages for curves and butterflies.[65]

103. The confusion about how Professor Grinblatt would calculate damages for curves, butterflies, and other package trades is complicated by the inconsistent approaches he proposed for estimating "but for" spreads for packages in his Initial Report and deposition. His Initial Report explained that the but-for spread for a package would be estimated "[u]nder the conservative assumption that the composite spread for a package trade would be equal to the spreads associated with trading each leg of the swap independently in the but-for world …"[66] But he does not address this question in his Rebuttal or explain how he would relate this approach to his new regression model for estimating the actual spreads paid on certain curves and butterflies.[67]

104. Professor Grinblatt's failure to identify in his Rebuttal Report how he would calculate the "but for" spread means that he provides no framework for calculating spread elevation for packages due to the alleged conspiracy. He also fails to describe how any measure

---

having such standard ratios. (Grinblatt Rebuttal ¶¶ 460 & 464-5.) He presents no framework for estimating predicted actual spreads for curves and butterflies that do not have standard ratios.

65. Grinblatt Rebuttal, Section E.1: "My Model Reliably Calculates Damages for Packages."

66. Grinblatt Rebuttal ¶ 290.

67. At his deposition, Professor Grinblatt discussed an alternative approach to estimating but-for spreads for packages. When asked "How do you add these two but-for spreads together", he stated that damages for packages would be calculated by "doing the DV01s on each leg" and then "add[ing] the two damages together." (Grinblatt Deposition 308:2-309:14.

of spread inflation for packages would be translated into damages, which his Initial Report notes needs to be "expressed in dollar terms and present valued."[68] Professor Grinblatt provides no discussion of how (or whether) either the notional value of the various legs of the package or the DV01 for the package would be used to calculate damages. He also fails to provide any examples of how damages would be calculated.

105. Professor Grinblatt presents no discussion of how damages would be calculated for packages that have non-swap components or packages for which he does not have CMPN midquotes. Packages involving non-swap components, such as futures and treasury securities, constitute a substantial share of D2C package trades. For example, [redacted] testified that [redacted].[69] My initial report also showed that approximately [redacted] of packages that could be identified in the Bloomberg and TradeWeb data were not curves or butterflies.[70] While Professor Grinblatt challenges the estimates of the frequency of these types of trades that Professor Johannes and I report, he does not appear to dispute evidence that packages involving non-swap elements constitute a substantial number and a significant share of package transactions.

B. Professor Grinblatt's analysis implies that significant numbers of curve and butterfly transactions were not harmed.

106. As discussed above, Professor Grinblatt uses transaction data from Bloomberg and TradeWeb for [redacted], together with CMPN midquotes for these contracts to estimate predicted actual spreads on those packages. As discussed in Section III

68. Grinblatt Rebuttal ¶ 290.
69. Reiss Initial Report ¶¶ 223 & 225 (citing the deposition of [redacted] 46:17-25 & 85:23-25).
70. Reiss Initial Report, Exhibit C.3 (showing [redacted] butterfly package legs, [redacted] curve package legs and [redacted] legs associated with other package types). The exhibit shows these "other package" trades were approximately [redacted] of total trades in the Bloomberg and Tradeweb SEF data and approximately [redacted] of notional.

above, CMPNs provide valuable, albeit imperfect, estimates of midquotes and spreads. I have used these data to evaluate the percentage of his package transaction sample that have zero or negative calculated spreads, which implies that customers on these transactions were unharmed.

107. Exhibit 14 shows that calculated spreads were less than zero for [redacted] of the package trades in Professor Grinblatt's sample. Similar patterns are observed for curves and butterflies separately. It is not possible to determine whether customers in transactions for the selected packages were unharmed under any alternative measure of "but for" harm because Professor Grinblatt has failed to define any such threshold. Professor Grinblatt provides no basis to conclude that the large share of negative spreads on package trades is due to measurement error.

Exhibit 14
Negative Calculated Spreads in Professor Grinblatt's Sample for Package Trades

	Number of Packages	% Less than or Equal to 0
Curves	[redacted]	[redacted]
Butterflies	[redacted]	[redacted]
Total	[redacted]	[redacted]

Source: Professor Grinblatt's Regression Samples (Models VI.14 and VI.15).

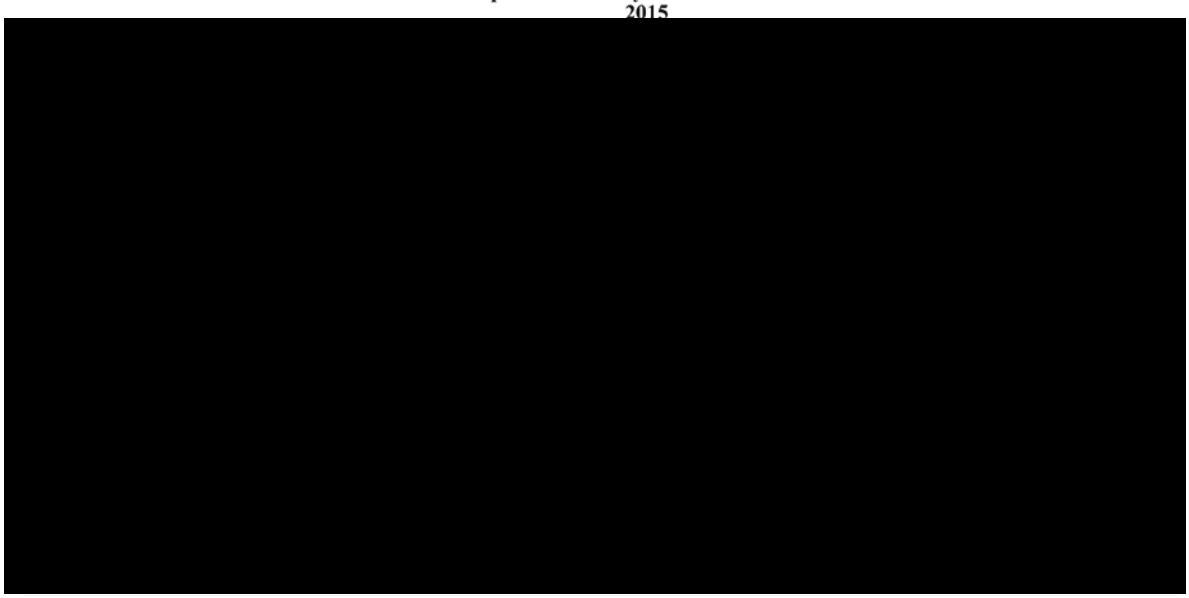
C. Professor Grinblatt's regression framework for estimating "true spreads" for package trades is unreliable.

108. Professor Grinblatt's regression estimates of actual world spreads are subject to the same limitations as those described above for outright swaps. Specifically, his framework unrealistically generates "predicted actual" spreads that are identical for observationally equivalent package transactions.

109. Exhibit 15 shows estimates of the effective spread generated by Professor Grinblatt's framework for a representative curve package category: US, 3-year/5-year, $50M traded in 2015, along with the calculated spreads for the 2015 transactions. Exhibit 16 presents the same information for a representative butterfly package.

Exhibit 15

Calculated and Predicted Spreads Based on Professor Grinblatt's Model VI.14
Representative Pay-Fixed Curve Trade
2015



● Calculated Spread ● Predicted Spread

Source: Professor Grinblatt's Regression Sample (Model VI.14).
Notes: Based on on-SEF cleared USD SWP CRV SA 3Y5Y Curve with $50 million notional on longer leg.

Exhibit 16

Calculated and Predicted Spreads Based on Professor Grinblatt's Model VI.15
Representative Pay-Fixed Butterfly Trade
2015

● Calculated Spread ● Predicted Spread

Source: Professor Grinblatt's Regression Sample (Model VI.15).
Notes: Based on on-SEF cleared USD BF SWP SA 2Y5Y10Y Butterfly with $100 million notional on middle leg.

110. The wide variation in actual spreads around regression-based predicted spreads shows that Professor Grinblatt's regression explains little of the variation in calculated spreads for curves and butterflies. The share of the variation in calculated spreads explained by his regression, using the correctly-calculated R^2 statistic, is [redacted] for curve trades and [redacted] for butterflies.

Peter Reiss

November 27, 2019

Appendix A

Appendix A

Materials Relied Upon

Court Documents

Memorandum of Law in Support of Plaintiffs' Motion to Exclude the Expert Report and Testimony of Dr. Peter C. Reiss, October 2, 2019

Expert Reports

Report of Darrell Duffie in Support of Class Plaintiffs' Motion for Class Certification, February 20, 2019

Revised Expert Report of Mark Grinblatt, Ph.D., April 2, 2019

Expert Rebuttal Report of Christopher L. Culp, Ph.D., June 18, 2019

Expert Report of Michael Johannes, June 18, 2019

Expert Rebuttal Report of Peter C. Reiss, June 18, 2019

Reply Report of Darrell Duffie in Support of Class Plaintiffs' Motion for Class Certification, October 1, 2019

Corrected Expert Rebuttal Report of Mark Grinblatt, Ph.D., October 11, 2019

Depositions

[redacted]

[redacted]

[redacted]

Academic Literature/Publications/Statistical Publications

William H. Greene, Econometric Analysis, 5th edition, (Prentice Hall, 2003).

Peter Reiss and Ingrid Werner, "Transaction Costs in Dealer Markets: Evidence from the London Stock Exchange," in The Industrial Organization and Regulation of the Securities Industry, Andrew Lo, ed., University of Chicago Press (1996), pp. 125-176.

Roger Koenker, "Quartile Regression," in International Encyclopedia of the Social & Behavioral Sciences (2nd Edition), James D. Wright, (Elsevier, 2015)

Robert N. Rodriguez and Yonggang Yao (2017) "Five Things You Should Know About Quantile Regression" SAS Support Paper SAS525-2017.

Peter Kennedy, A Guide to Econometrics, 6th edition, (Wiley-Blackwell, 2008).

Data Sources

Grinblatt Backup

All other documents cited in this report and exhibits.

Appendix B

Appendix B

Plaintiffs' Mischaracterization of Reiss and Werner

1. Plaintiffs' Motion to Exclude ("Motion") cites and then mischaracterizes a paper, "Transaction Costs in Dealer Markets: Evidence From the London Stock Exchange," that I co-wrote with Professor Ingrid Werner.[1] Professor Grinblatt also cites this paper and he too mischaracterizes it in several ways.[2] This Appendix discusses these mischaracterizations and explains how the analysis in that paper does not relate to Professor Grinblatt's regression analysis. In short, Professor Grinblatt uses one type of regression analysis (ordinary least squares) to try to estimate the true value of a swap, i.e., its true *half*-spread. I use a very different type of regression analysis (quantile regression) to evaluate the *distribution* of *full-round trip* spreads; I do not use it to try to estimate true values or half-spreads. These two tasks are entirely different. It is incorrect to suggest that my paper tells us anything about how to go about estimating true values or true half-spreads for individual IRS transactions.

2. My paper with Professor Werner conceptualized and then constructed several measures of the "round-trip" cost of a London equity transaction. The cost of a "round trip" is defined as the net cost of simultaneous buy and sell transactions. For example, it is the cost if an agent/entity were to buy and sell simultaneously 1000 shares of Abbey National at 2:21 p.m. As explained in Sections II and III of this Reply, and in Section III.E of my first Report, the spreads

---

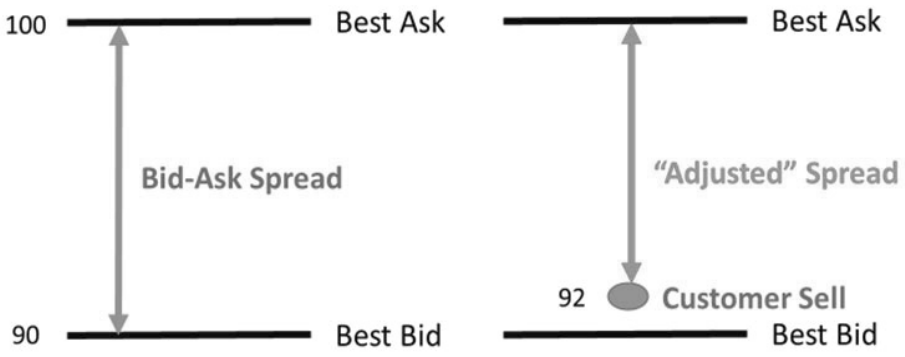
1. Peter Reiss and Ingrid Werner, "Transaction Costs in Dealer Markets: Evidence from the London Stock Exchange, in The Industrial Organization and Regulation of the Securities Industry, Andrew Lo (ed), University of Chicago Press (1996), pp. 125-176.

2. One example is at [¶ 379]. Professor Grinblatt states we consider "and rejects an effective spread measure constructed as a deviation of the price from the midpoint of the market's best bid and ask…" As stated below, our paper was not about measuring effective spreads. We did remark in passing when discussing bid-ask spreads "It is unclear why the touch midpoint is **the best way** to measure a SEAQ security's true value." Saying it is not "the best way" is hardly an outright rejection of midpoints. Also note the same over-reach is made at [¶ 383]: "In addition to rejecting the deviation of prices from mid-quotes as reliable measures of spreads …" Again, our paper made no such statement.

at issue in this matter are different. They are effective spreads and pertain to the cost of a one-way transaction (e.g., a buy or a sell). A major difference between a round-trip cost (or full spread measure) and a one-way cost (or half spread measure), is that to estimate half spreads it is necessary to take a position on the true or market value of the financial instrument.

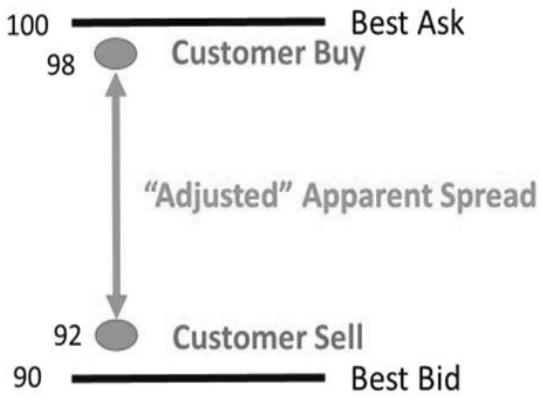
3. To illustrate what the Reiss-Werner paper does and why it does not involve estimating true value, it is useful to refer to the diagrams below (which are variants of figures in our paper). On the left of the first figure, the vertical blue line displays a market bid-ask spread. The bid-ask spread is 10, or the ask (buy) price of 100 minus the bid (sell) price of 90. This is one obvious measure of the cost of a round trip because if the quoted prices are "firm", a customer can buy at the ask (100) and sell at the bid (90). Again, the net cost of the round trip is the bid-ask spread of 10. To calculate this round-trip cost, no notion of the "true value" of the security was needed.

4. On the right, I illustrate why the bid-ask spread may not always be a good round-trip transaction cost measure. I depict a customer who has sold at a better price of 92 (blue circle). This is a better price than the guaranteed quoted price of 90. In our paper, we discuss dealers' motives for offering to improve the quoted prices.



5. Because this customer in principle could have reversed the (sell) trade by buying at the (guaranteed) best ask, a better measure of the customer's round-trip transaction cost is what we call in our paper the "adjusted spread" – the difference between the best ask and sale price. Here this is 100 – 92 = 8, that is a net round-trip cost of 8. Like the bid-ask spread, the adjusted spread could be observed directly in the London data using quotes and transaction prices. Notice again, that to calculate the adjusted bid-ask spread, no reference to or measure of the stock's "true value" is required.

6. Our paper also notes that the adjusted spread potentially overstates the cost of a round trip. Potentially this customer could have been granted a discount from the best ask as well. Such a situation is depicted below.



7. Because we rarely observe a customer simultaneously buying and selling the same security in the same amount, we need to estimate the (hypothetical) discount from the best ask (or bid) a customer would have received.

8. Our approach is to model the frequency *distribution* of discounts from the bid or the ask using quantile regression. A quantile regression tells us the *frequency* with which a non-specific customer gets no discount (i.e., pays the bid-ask spread) versus gets an improvement of

the quoted prices of, say, 1. For example, the quantile regression might indicate that 20% of the time customers get a discount of 1; 10% a discount of 2; etc. We use the estimated distribution(s) to define and calculate *adjusted apparent spreads*. The adjusted apparent spread presumes that the discount the customer would pay is symmetric. That is, the distribution of the discount to the round-trip bid-ask prices is symmetric. So, for example, 80% of the time the adjusted apparent spread is equal to or less than 8.

9. There are two important points to emphasize. First, nowhere in this summary of adjusted spreads or apparent adjusted (bid-ask) spreads are there references to "true values", "half-spreads" or effective spreads (or having to estimate them). Second, the paper does not use the same regression method that Professor Grinblatt does. He uses "ordinary least squares" regression and we use quantile regression. Plaintiffs fail to draw a distinction between these two very different types of regression methods -- just as they conflate the generic term "spread" to refer both to my round-trip or bid-ask spreads and the one-way or effective spreads at issue in this matter. Here, Plaintiffs say that we and Professor Grinblatt both use "regression", which incorrectly implies we rely on the same estimation methodology. We do not.

10. One final and somewhat technical note to explain quantile regression further. Quantile regressions are about estimating the properties of distributions (here, distributions of adjusted spreads or discounts). Ordinary regressions are about predicting particular outcomes (e.g., what the adjusted spread would be for an average trade). What to make of this difference? Here is one summary from the purveyors of the widely used SAS Software system:

> ``The increasing complexity of data in research and business analytics requires versatile, robust, and scalable methods of building explanatory and predictive statistical models. Quantile regression meets these requirements by fitting conditional quantiles of the response with a general linear model that assumes no parametric form for the conditional distribution of the response; it gives you

> information that you would not obtain directly from standard regression methods…"[3]

11. To summarize, Plaintiffs' *Motion* relies heavily on the idea that (i) Professor Grinblatt and (ii) Professor Werner and I both estimated models of "spreads" using "regression" and that those regressions were somehow about the half-spread measures (and true values), which are the measures that are at issue in this case. Professor Grinblatt and Plaintiffs are wrong on both counts – the papers use distinct measures of spreads and distinct statistical analyses.

3. By standard regression methods they are referring to among others the regression methods used by Professor Grinblatt. Quotation source: Robert N. Rodriguez and Yonggang Yao (2017) "Five Things You Should Know About Quantile Regression" SAS Support Paper SAS525-2017.

Appendix C

Appendix C

Reconciling Spread Regression Models

1. Professor Grinblatt mischaracterizes my report's development of a spread regression model at several different points. He suggests that my spread version of his regression model is radically different than his own version of the model, when in fact my version is equivalent to his spread versions of his models and generates the same coefficients. Further, the higher R^2 he reports for his regression is the result of his misuse of R^2. The R^2 he reports is not for a model of spreads, but rather a different and non-economic dependent variable that differs from half spreads! In this appendix, I explain both errors and why my version of his regression model and reported R^2 values are correct.

2. To understand the model I estimated in my initial report, and why it faithfully represents a spread version of his "rate model", I start with equation (1) in Professor Grinblatt's Rebuttal [¶ 376]

$$Fixed\ Rate = True\ Rate + TD * Spread \qquad (1)$$

3. In this equation, *TD* stands for Trade Direction. It is an indicator variable equal to 1 for buys and -1 for sells. One mathematical fact I will use is if one multiplies *TD* by itself to get TD^2, then $TD^2 = 1$ for every transaction in the underlying data. This implies that if we multiply both sides of the equation above by *TD* (which does not change the validity of the equation), we get

$$TD * Fixed\ Rate = TD * True\ Rate + TD^2 * Spread = TD * True\ Rate + Spread$$

This can be re-expressed as

$$Spread = TD *(Fixed\ Rate - True\ Rate).$$

4. Professor Grinblatt's next equation (2) [¶ 381] is his "rate" regression

$$Fixed\ Rate = b + c\ Mid + TD * d * X + e \qquad (2)$$

where *b, c* and *d* are regression coefficients to be estimated, *Mid* is the midpoint of the CMPN quotes, *X* are a set of variables that he claims determine the spread the dealer charged (e.g., year, notional and tenor) and *e* is the regression error term. Comparing (1) and (2) it is clear[1]

$$True\ Rate = b + c\ Mid$$

$$Spread = d * X$$

5. Professor Grinblatt states *e* represents "estimation error" (¶ 381). Because this regression is a model of fixed rates, he must believe that this is estimation error for fixed rates. Were he to believe the error represents estimation error in half spreads, he would have had half spreads as the dependent variable of his regression.[2]

6. His fixed rate regression's implied spread accuracy is what I want to evaluate. To do that, I now show how I converted his rate regression to a spread regression. (That is a regression with half spreads as the left hand side dependent variable.)

7. Professor Grinblatt states that I estimate what he calls equation (4) (¶ 402)

$$TD\ x\ (Rate - Mid) = b\ Payer + (c\text{-}1)\ Mid + d * X + error$$

This is not correct. The model I estimate includes an intercept. My version of his equation (4) can be called (4')

$$TD\ x\ (Rate - Mid) = a + b\ Payer + (c\text{-}1)\ Mid + d * X + error \qquad (4')$$

1. In ¶ 381, Professor Grinblatt states "The term $d \cdot X$ represents the effective spread embedded in the fixed rate…"
2. Professor Grinblatt at times states the CMPN is "noisy" and contains "measurement error". If in fact he believes CMPN is a noisy measure of the True Rate, then he has in his regression a right hand side variable with measurement error. This widely studied problem in econometrics is known to bias coefficient estimates, not just the ones of the variables with measurement error. *See* e.g., Greene, William H., Econometric Analysis, 5th Edition, Prentice Hall (2003) at 85-86 ("It is common for only a single variable to be measured with error. One might speculate that the problems would be isolated to the single coefficient. Unfortunately, this situation is not the case. … The other coefficients are biased as well, although in unknown directions. A badly measured variable contaminates all the least squares estimates."). Professor Grinblatt is wrong to say he knows there is no bias from measurement error just by looking at one coefficient.

8. To see that (4') actually is a more general version of his model, start from his equation (2) and subtract the *Mid* from both sides, giving (2')

*Rate – Mid = b + (c-1) Mid + TD * d * X + e* (2')

9. Now Professor Grinblatt says he believes c = 1.[3] (His original estimate is c = [redacted].) Thus, *Mid* drops out and we obtain (2'')

*Rate – Mid = b + TD * d * X + e* (2'')

10. Although the left hand side looks like the definition of a half spread, notice it only equals the half spread for customer buys. For customer sells, the half spread is

Mid – Rate = -1 x (Rate – Mid)

11. Thus, *Rate – Mid* is NOT the definition of a half spread. However, if we multiply *Rate – Mid* by 1 for buys and -1 for sells, then we obtain the correct definition of a half spread. This, multiplication is exactly what is accomplished by multiplying *Rate – Mid* by the variable *TD*. That is, as we saw in ¶ 3 above:

Half Spread = TD x (Rate – Mid)

12. To convert the left-hand side of Professor Grinblatt's (2'') to Half Spread, multiply both sides of (2'') by TD [4]

TD x (Rate – Mid) *= b TD +* ***d*X + e*** (2''')

How does this equation compare to the equation (4') that I estimated?

TD x (Rate – Mid) *= a + b Payer + (c-1) Mid +* ***d*X + e*** (4')

To make comparison easy, I have **bolded in blue** the obviously common terms.

3. Grinblatt Rebuttal Report, ¶ 441-442.
4. It may seem as though a TD^2 term is missing from (2'''), but observe that since TD is either 1 or -1, that , TD^2 always equals 1. Thus, TD^2 drops out of (2''').

13. Now note my model (4') includes an intercept *a*, whereas the model implied by Professor Grinblatt's Rate model (2''') does not. The addition of an intercept is necessary because without an intercept, R^2 has no standard meaning. My model includes *Mid*, whereas (2''') does not. As is well known in the econometric literature, including an additional variable such as *Mid* to see if the coefficient c is one can only increase R^2 (which also works in Professor Grinblatt's favor). Thus, by including *Mid*, I am being conservative in two ways: not assuming c = 1 and increasing the estimated R^2 of Professor Grinblatt's model.

14. However, assuming $c = 1$, the only difference between (2''') and (4') is Professor Grinblatt would include the variable *TD*, whereas I included *Payer*. In turns out that using either variable in this case *leads to the same model and results*. To understand why, notice the two variables are related. *Payer* is a variable equal to 1 when the customer buys and zero otherwise. We can also define a variable *Receiver* which is 1 when a customer sells and zero otherwise. Now by construction a trade is either a buy or sell, so

$$Payer + Receiver = 1$$

15. Now notice that *TD* is equal to 1 when customer buys (customer is payer) and -1 when the customer sells (customer is receiver). Therefore, we have

$$TD = Payer - Receiver$$

16. Thus, if we substitute these expressions into (2''')

$$\begin{aligned} TD \times (Rate - Mid) &= b\,TD + d^*X + e && (2''') \\ &= b\,(Payer - Receiver) + d^*X + e \\ &= b\,(Payer - (1 - Payer)) + d^*X + e \\ &= -b + 2\,b\,(Payer) + d^*X + e \\ &= a + b'\,Payer + d^*X + e && (2^*) \end{aligned}$$

Notice that this equation is a special case of the model I estimated! (One that assumes $c = 1$.)

17. Thus, it turns out that the equation I estimated is the same (or can be more general) than what Professor Grinblatt's original spread regression implies. Moreover, it is the equation he says I should have estimated, apart again from my adding a constant term, which again is necessary to interpret R^2.[5]

18. To summarize the discussion to this point and be clear, Professor Grinblatt's statement "However, Dr. Reiss has made a mathematical error in deriving this model." ¶ 403 is false. It is Professor Grinblatt who has made the error!

19. To show that the model I estimated is in fact the one Professor Grinblatt would have had me estimate, Exhibit C.1 reproduces the results for (Professor Grinblatt's) spread model (2''') also including an intercept, and my spread version of his original model (4'; without mid and with the Payer indicator) using the new dataset of his Rebuttal Report. The results for the latter are the first column of estimates; the results for the former are in the second column of estimates (third column overall). The second half of C.1 reproduces the same two specifications, only using Professor Grinblatt's positive-negative spread dependent variable and instead interacting the explanatory variables with trade direction (TD). (These latter specifications are similar to Professor Grinblatt's model in his Rebuttal Table IV.2, except that they also add TD or Payer.)

5. The point that regression programs do not correctly calculate R^2 when there is no intercept is widely known. For example, "Be aware that R^2 has no meaning if there is no intercept. In general, do not pay much heed to R^2." P. Kennedy (2008): *A Guide to Econometrics*, sixth edition, p. 380.

Exhibit C.1

Comparison of Results of Spread Regression and Professor Grinblatt's Positive-Negative Spread Regression

	Dependent Variable: Spread				Dependent Variable: Positive-Negative Spread			
	Explanatory Variables Not Multiplied by Trade Direction				Explanatory Variables Are Multiplied by Trade Direction			
Parameter	Estimate	T-Value	Estimate	T-Value	Estimate	T-Value	Estimate	T-Value
Intercept	[redacted]							
Payer								
Trade Direction								
Off-SEF, Uncleared 2013 & 2014								
Off-SEF, Uncleared 2015								
Off-SEF, Uncleared 2016								
Off-SEF, Uncleared 2017								
On-SEF, Uncleared 2013 & 2014								
On-SEF, Uncleared 2015								
On-SEF, Uncleared 2016								
On-SEF, Uncleared 2017								
Off-SEF, Cleared 2013 & 2014								
Off-SEF, Cleared 2015								
Off-SEF, Cleared 2016								
Off-SEF, Cleared 2017								
On-SEF, Cleared 2013 & 2014								
On-SEF, Cleared 2015								
On-SEF, Cleared 2016								
On-SEF, Cleared 2017								
Notional 2013 & 2014								
Notional 2015								
Notional 2016								
Notional 2017								
Tenor 2013 & 2014								
Tenor 2015								
Tenor 2016								
Tenor 2017								
Trading Intensity 2013 & 2014								
Trading Intensity 2015								
Trading Intensity 2016								
Trading Intensity 2017								
Number of Observations	[redacted]							
R-Square								

Source: Professor Grinblatt backup.

20. Notice all coefficients are exactly the same, apart from those on the intercepts, and coefficients on *Payer*, and *Trade Direction*. However, equation (2*) above shows that the

coefficient on *Payer* should be exactly twice that of the coefficient on *Trade Direction* (which it is in the table). Notice too from equation (2*) that any intercept of equation (2''') should be the same as intercept in (2*) when adjusted for the coefficient on trade direction. From the table above, [redacted].

21. Finally, notice that the R^2 (and adjusted R^2) based on this new data for both models is 10.1% – not the approximately 41% that Professor Grinblatt reports.

22. In summary, Professor Grinblatt has made a clear error in asserting that I made an algebraic error in formulating a spread version of his model. What I have shown here is that there is no error, and the model Professor Grinblatt says I should have estimated is in fact the one that I estimated. The coefficients are the same (or the same up to addition and subtraction); the predictions are the same. Further, the appropriate R^2 for the model is 10.1% and not the 41.1% (or more) that Professor Grinblatt associates with the model.